

**RESIDENTIAL BUILDINGS
SUITED TO INDIA**



RESIDENTIAL BUILDINGS SUITED TO INDIA

જી૦ બીરેન્દ્ર વર્મા પુસ્તક-સંગ્રહ

BY

R. S. DESHPANDE, B. E.,

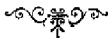
*Author of "Sulabh-Vastu-shastra" or
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R. S. DESHPANDE, B. A.

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PREFACE

The very cordial reception granted by the press, profession and public at large to my *Sulabh-Vāstu-shāstra*, a practical treatise on Building Construction in Marathi (which, by the way, is being translated into Gujarathi, Kanarese and Hindi), has encouraged me to venture to publish the present volume which essentially deals with the aspect of planning domestic buildings suited to Indian conditions and social customs.

The process of compiling the notes and drawing and compressing the plans herein embodied has, by no means, been a light task, particularly as the work has been done in the moments which could be spared from activities mostly in the field of brick and mortar which are hardly conducive to attempt a work of even a semi-literary character. Besides, in order to widen the field of usefulness of the book an attempt has been made to write it in a foreign language which has been a further handicap. It would, therefore, be no wonder if there were mistakes in it. Corrections from any source whatever will be gratefully received and considered.

The labour involved in preparing the plans was certainly not exhilarating and in fact there were moments when, I thought of giving up the attempt. But the encouragement, appreciation and help received from various quarters has prompted me to persevere in my undertaking and now that I have seen the work through in a book form I heave a sigh of relief. It is impossible to mention and thank in the brief space of a preface the

numerous friends who directly or indirectly rendered valuable assistance to me. I cannot, however, refrain myself from offering my hearty thanks to **Mr. R. B. Junnarkar**, Supervisor, P.W.D., Bombay and to **Mr. B. B. Kamat**, Inspector of Science Teaching, Bombay Presidency, for their great help, without which it might not have been possible to produce the book in the present form. My respectful thanks are tendered to the old and venerable gentleman, Rao Bahadur **V. N. Parulkar**, M.I. E., I.S. E. (retired) who having appreciated my industry uniformly encouraged me from the very beginning and at my request, went through the preliminary notes and a few plans and made very valuable suggestions.

I am thankful to Mr. L. V. Sathe, G.D., A.R.C, Architect Bombay for supplying the plans in pages 256 to 266.

I must express my thanks to Mr. M. G. Deshpande, proprietor, the Kohinoor Photo-Zinco, for so nicely preparing the blocks of all the plans in the book and the Manager, Aryabhushan Press for the very good printing work done.

Finally, I desire to acknowledge my indebtedness to the authors of the books mentioned in the Bibliography which follows for the great assistance their excellent works have been to me, not only in connection with this book, but also, and even to a greater extent, in solving difficult problems in construction in practical works on my hand.

Saraswat Brahmin Colony }
 POONA
20th March 1931.

R. S. DESHPANDE.

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LIST OF BOOKS CONSULTED.

- (1) The Cheap Cottage and Small House—Gordon Allen.
- (2) The Principles of Planning Building—Percy L. Marks.
- (3) How to Plan a House—G. Gordon Samson.
- (4) Houses and Villas for Britishers Abroad.—G. Gordon Samson.
- (5) Houses Planned for Comfort—G. Gordon Samson.
- (6) Valuations and Compensations—Banister Fletcher.
- (7) Erection of Dwelling Houses—S. H. Brooks.
- (8) Industrial Housing—Morris Knowles.
- (9) The Housing Handbook—W. Thompson.
- (10) Dangerous Structures—G. H. Balgrave.
- (11) Modern Buildings, Volumes I, II and V—Henry Adams.
- (12) How to Estimate—J. T. Rea.
- (13) The Modern House Constructions Vols I, II and IV—G. Lister Sutcliffe.
- (14) The Book of Bungalows—R. Randal Phillips.
- (15) Concrete Cottages, Bungalows Garages—Albert Lakeman.
- (16) Building Construction (Advanced Course)—Mitchell.
- (17) Bombay Municipal Bye-laws.
- (18) Science of Building—E. Windham.
- (19) Practical Housing—J. S. Nettlefold.
- (20) Bungalows and Country Residences—R. A. Briggs.

(21) Cheap Dwellings Actually Built—Paul N. Hasluck.

(22) Bungalow Residences—T. Harrison.

(23) The "Country Life" Book of Cottages—Lawrence Weaver.

(24) Practical Bungalows and Cottages for Town and Country—Fred T. Hodgson.

(25) Rural Hygiene—G. V. Poore.

(26) Public Health and Housing—J. E. J. Sykes.

(27) Sanitation in India—J. A. Turner and B. K. Goldsmith.

(28) Essay on the Architecture of the Hindus—Ram Raz.

(29) Essentials of Architecture—John Belcher

(30) History of Architecture—Banister Fletcher.

(31) Painting Materials—Charles L. Condit and Jacob Scheler.

(32) A Manual of Painting—Ellis A. Davidson.

(33) Leaflets 1 to 47—Cooperative Housing Association, Bombay.

INTRODUCTORY.

To build a home is a primary instinct to be found throughout the whole animal kingdom. Rats and moles dig holes under ground. Ants build up anthills; birds build their nests—some of them with such an ingenuity as would put to blush even the 20th century architect. The mathematical accuracy and the sense of economy displayed by bees in the cells of a honey-comb are very striking.

Man himself is no exception in this manifestation of the primary building-instinct, inspite of the boast that he stands high above the level of other animals. One has only to watch his activities in childhood—the period he stands farthest from the “Civilised man” he loves to term himself. Whenever children play under a roof or on the sands, their most pleasant occupation will be found to be to “make a house” or to “play at keeping a house” with all sorts of improvised materials and make-beliefs. Recall, Dear Reader, the faint memories of your childhood and verify for yourself the truth about this building-instinct even in man.

Particularly in India is this instinct sanctified by usage. It is the peculiar trait of the Indian mind to look upon the ancestral home with an amount of sanctity. If he inherits none, he must build or acquire one. With him “No home” is “No status”. The status and the respectability of a man is

largely gauged by his possession of a house to live in. Mere wealth, however immense, does not give him that status in society which even a man of slender means can command if he owns an humble cottage. So strong is this sentiment that people of all grades and professions—merchants, lawyers, doctors,—all love to invest all their savings, even though meagre, in building or acquiring a house, even though the prospects of a return may not be so bright as in other forms of investment.

Yet, inspite of this fact that so much importance is attached to one's own home, it is a pity that very few people give it the due thought and attention which this matter of vital importance deserves. Except in a few cities in which Municipal or Executive Authorities compel the owners by law to submit the plans of proposed buildings, no one ever attempts to do so and even in the case of the plans submitted they are just sufficient to satisfy the Municipal requirements.

This apathy towards seeking systematic, scientific advice must, however, disappear. Of recent years, there has been a marked tendency of people to purchase a small plot of land on the outskirts of a city or a town and to build on it one's own cottage in preference to dwelling in dingy, stuffy, old, rented houses in the urban area. This is no doubt a hopeful sign; but what usually happens is that the overflowing enthusiasm of people prompts them to try their own hand at planning without the necessary knowledge, discrimination and experience, which the importance of the work demands. No plan is drawn, no estimate is framed and

sometimes the building work is started even without the necessary funds at the owner's disposal. The work of construction is entirely left to the mercy of the quasi-literate maistry or illiterate carpenter or to a class of contractors hardly equipped with any systematic training in their art. Most of the latter usually belong to the same category of people as maistries and masons, but have risen to a slightly higher level due to some turn of good fortune. Most of them, however, are generally equally incapable, more or less, to properly grasp the ideas of a decent living, and to provide for the arrangements and comforts which a cultured man with a delicate and refined sense of decency, demands. To make confusion worse confounded, laymen friends pay kind visits and dole out suggestions while the building work is in progress, though with the best of intentions, yet equipped with sheer ignorance: "Nine feet floor height makes the building look ugly; it should be at least 11 feet. Mr. So and So's bungalow looks like a palace with that height. Such things are done once in a life time. Don't spoil your bungalow for the sake of a few rupees" and so on. These "few rupees" in so many items go to swell the cost by 50 p. c. which the owner cannot realise. But when the time for payment comes in, his eyes are opened, his enthusiasm gets a rude shock and often times the property falls into the hands of the creditor. Apart from the inflated cost which is the natural result of such houses built under these circumstances, the house, or rather a "masonry box" with a tiled lid affording protection from the sun and wind—(not to say, "from rain" because the roofs of

such houses are often hospitable enough to welcome rain inside)—fetches very little value in the market when offered for sale.

There is only one way to avoid such a catastrophe; viz., to get a suitable plan drawn and a complete estimate framed with the help of some architect who knows his job well. It is a "penny wise and pound foolish" policy to grudge spending a trifling amount for this very important matter. The preliminary design may be made by the owner to indicate his special requirements to the architect, but beyond that it is advisable to leave the details to his experienced and mature judgment. Still, on the other hand, howsoever clever and expert an architect may be, it is impossible for him to gauge correctly the peculiar requirements, the likes and dislikes, the prejudices and idiosyncrasies of his client. I have come across some doctors and professors who have eminently distinguished themselves in their own lines but have exhibited gross ignorance of even the correct idea of dimensions. An average person, if he but takes a keen interest and approaches the subject in a spirit of determination to study and choose the best, can easily master the art of house planning in a short time. He should first begin with measuring with a tape the dimensions of the rooms he is occupying, the doors, windows and all other details, so that he can at once determine what bigger or smaller sizes would exactly suit him. The next lesson is to actually visit a few typical houses of his friends and note the conveniences or otherwise experienced by them for his guidance.

A practical hint, in this connection, would, I hope, be not out of place here. If the house which is going to be built is calculated to give happiness to the family, one must take the counsel of the partner of his life's happiness in respect of its planning. We give the lady of the house the high sounding title such as 'Grihini' or "Grihlakshmi" i. e. "mistress of the house," "The presiding deity of the house" and still do not consult her even in respect of the kitchen arrangements with which she alone is concerned. It is a mistake to suppose that a woman cannot understand these things. On the contrary the term "Better half" given to her proves itself to be literally true in this respect. Ladies are very sensitive to appreciate the conveniences and especially to feel the inconveniences of a living house. That is, par excellence, *their* sphere of life. Measured in hours they live in the house more than we do. You will be surprised to find what an amount of common sense your wife will show in criticising the plan of a house and making suggestions in respect of conveniences, delicacies and refinements of arrangements which we, of sterner sex, could scarcely think of.

Very direful is the result of this obvious omission. Its bitter experience comes to the lot of the unfortunate house-owner. Soon after the eventful day which he had so eagerly been longing to see, viz: the day on which the palatial building of his proud ownership is first occupied, he is constantly heckled by sarcastic criticism by day and dread curtain lectures by night, such as, e. g., "The bathroom is too small;" "the staircase should have been

in that place;" "the sink would have been better in that corner;" "the smoke outlet does not work;" "there is absolutely no seclusion for worship or offering prayers in the whole house;" and so on. His eyes are now opened, his pride of possession melts away, his enthusiasm is crushed, the fool's paradise crumbles to the ground and he finds his life not worth living and though the inner sense of his vanity would not allow him to own defeat and frankly apologize, he repents for his folly in not having allowed his "better-half" a part in the counsel which would have at least saved him from such searching criticism.

What does exactly connote good planning? When is a house said to be well designed? The answer is not far to seek. A house designed economically, which preserves the health of the inmates and adds to the comfort and happiness of the family may be said to be well designed. A good house must exactly suit the family, just as clothes do the wearer. The external embellishment, the overflowing, elaborate architectural features contribute very little to make a house comfortable. The value of a house designed for comfort will certainly be enhanced if it synchronises with external beauty. But a house with the best exterior may be found to be a failure as an investment when compared with a cosy, plain-looking cottage solely designed for convenience and comfort.

When we see all around us, we find that there is a general tendency, which is increasing every day, of people to leave healthy villages and flock to industrial centres in crowded cities. This exodus

has been caused by a good many deep-rooted causes, mostly economic, such as poverty, depression of agriculture, lack of educational, banking, marketing and medical facilities, habits of uneconomical living, attractions of city pleasures and enjoyments, and so on. This has resulted in creating a dearth of houses both in towns and villages—in towns because there is a house-famine and in villages because the houses which are deserted crumble to ground for want of care. The evil consequences of the house-famine which has affected every grade of society living in towns are the inflation of rent and overcrowding of rooms, of which the latter brings in its train, high death-rate, especially amongst infants, mental restlessness, physical weakness, lung diseases, and the lowering of general vitality etc.

The abnormal rise in the cost of foodstuffs and clothing on account of the outbreak of the Great War, added fuel to the fire and made the position of the middle and lower classes still worse, in spite of the Rent Act, which came to their assistance for some time at Bombay and some other places, to give them some relief. They could not but submit to the unreasonable demands of their landlords. But after some time when prices of foodstuff and clothing showed some improvement, they were prepared to take every opportunity of throwing off the yoke and be independent of their landlords by trying to build small cottages on the outskirts of towns. The Co-operative Societies' movement, inaugurated by Government, promoted their efforts by offering

them loans at low interest if they formed themselves in to a registered Society. The efforts of the Development Department, Bombay, further stimulated them by offering concrete examples of cheap dwellings and it is now a hopeful sign of the time that people have realised that, instead of paying abnormal rents and living in the midst of unnatural conditions, they could, with a loan raised from Government, build, in the midst of healthy surroundings, cottages according to their own choice which will ultimately become their own, if they paid, monthly instalments for a fixed period, instead of monthly rents. It is very satisfactory that a number of Cooperative Housing Societies are fast springing up.

While endeavouring to promote one such Society, viz., the Saraswat Brahmin Colony, in Poona, of which I have the privilege of being one of the prime organisers, I got a unique opportunity to study the problem at first hand and realise the difficulties which confront the laymen, who for want of facilities have to design their own houses and entrust the construction to the semi-literate maistry. I very much deplored this state of affairs and resolved to try to relieve the situation partially by (1) writing practical notes, preferably in vernacular, on building construction in a manner easily intelligible to the lay mind and (2) publishing a few typical plans of cottages suitable for Indian climate and social customs. The former took the shape of a book in Marathi which has been very enthusiastically received by the public and I am glad to state that, it is being translated into other

important vernaculars of India. The present volume is the result of my attempt to carry out the latter part of my determination.

In this volume I have sought to deal mainly with plans to illustrate the disposition of rooms, offices etc. in domestic buildings. I have in no sense made an attempt to deal with the details of construction or of architecture,—these subjects open up a very vast field and the reader is requested, particularly in respect of the former, to refer to my practical treatise on building construction. It is being translated into English also in which construction is dealt with in detail. Here, I have sought to cater mainly for the middle and lower classes. The few plans of large and rather costly houses might, however, interest the richer class. Again, there is a class of builders who look upon building as an investment from the point of view of business. To them I should like to offer the advice, to build houses not on a commodious plan but compact ones suitable for the middle classes which are sure to be always in demand. The designs of flats and chawls given in this volume will be very much appreciated by them.

It is to be noted that the plans herein given are intended to be merely suggestive and to supply ideas. They are never meant to be blindly adopted in toto as they stand. This remark is still more applicable to the elevations given which are merely expository and admit of any desired alterations.

I have drawn these plans and written the notes in my spare moments, little bits of time, which I could spare after fulfilling my official and other

duties, in consequence of which, naturally years have passed by, fresh experience being added to my ideas and improving upon them. I do not claim that the experience so gained has attained maturity or perfection, but conscious as I am, of the many defects and imperfections I have ventured to embody the same into a concrete book form with a sincere desire to be of some use to laymen who are greatly handicapped in a technical subject like building on modern lines. If the book proves to be of some use in this direction I shall feel myself amply rewarded.

Before I conclude, a word by way of explanation of the figures of costs quoted in the book would not be out of place. For working out these costs a few typical estimates of each class of buildings were framed with the rates of material and labour at present (1930 Sept.) current in Poona and the results were compared with the costs of a few buildings actually constructed. The rate per sq. ft. of plinth area, thus arrived at, has been taken as a basis for working out costs, to which some constant figures are added to meet the extra cost for special features such as bay-windows, turrets, nooks, projections, etc.—They do not include costs of site, fencing, drains, electric fittings etc. It is hoped that they will serve as a rough guide to people who have so far been groping in the dark.

Suman-vikas,
Saraswat Brahmin Colony }
POONA 2,
15th December 1930.

R. S. DESHPANDE.

Rough Cost.

When the layman has decided upon the length and breadth of the house to suit his requirements as set forth in the foregoing Introduction, the next question which confronts him is approximately to estimate its cost and see how it suits his purse. Very often the Maistry, whose help he seeks, has either got no clear idea about it or in his attempt to please his constituent, intentionally quotes a low figure. And, when the actual construction ultimately costs him double the amount, he blames the maistry, but the latter escapes all responsibility saying that the additions and alterations subsequently made by him (the owner) are responsible for the increased cost and that therefore no blame attaches itself to him. Though this may be partially true it is not wholly so. The owner now realises how he was be-fooled. In order, therefore, to save oneself from such a calamity it is, absolutely necessary that there should be some rough and ready rule to find out at once what a particular sized house is going to cost or what size of a house one can build within a certain amount, which one can afford to spend. The following rule will serve that purpose very well:—

Multiply together the length and breadth of the plinth (both in ft.) and find out the plinth area of the house. Multiply this by one of the rates given below according to the character of the structure specified opposite to them.

Note:—The rate per square foot of plinth area mainly depends, amongst many factors, upon the cost of labour and materials and may slightly vary according to the locality and also market fluctuations. Those, given below, have been worked out for conditions obtaining in Poona at present. In big cities cement and hardware materials and skilled labour are cheap but un-skilled labour is costlier than in the rural districts. For an ordinary building the cost on account of labour is roughly 35 per cent and that on account of materials 65 per cent approximately. Out of the 35 per cent required for labour, 49 per cent go to the un-skilled and 51 per cent to the skilled labourers. However, the figures of approximate cost arrived at, are sufficiently accurate for the purpose.

- (1) Stone or burnt brick in lime masonry, including cement pointing on the outside and lime plaster on the inside; flooring of Shahabad stones on 3 inches lime concrete in all rooms; half-panelled and half-glazed or fully glazed doors and windows; Mangalore tiled roofing on teakwood ceiling; height of floors 10 to 12 ft., that of plinth 3 ft; all other work not very ornamental but strong and decent... Rs. 5.
- (2) Stone or burnt brick in lime masonry, including cement pointing on the outside and lime plaster on the inside; Shahabad paving on three inch lime concrete in all rooms; Mangalore tiled roof on corrugated iron sheets; half-glazed and



half-panelled doors and windows only in the drawing room and plane-planked, in the remaining; height of floor 9 ft. and that of the plinth 2 ft; all other work strong, but 2nd class in quality...

Rs. 4-8.

- (3) Framed structure of round teak ballies (posts of rafters) with stone or burnt brick in mud masonry for walling; lime pointing on the outside, mud plaster inside; Shahabad or Katni slab paving in important rooms only, and murum flooring in the rest; country round, Mangalore or Allahabad tiled roof on battens; doors and windows all plane planked; height of floors 8 ft and that of plinth $1\frac{1}{2}$ to 2 ft. ... Rs. 3-12.

The above constants are applicable to single storey structures only. For two-storied buildings 0.25 Rs. or four annas should be deducted from them. e. g. suppose Rs. 10,000 are available for building purposes. One can build a house with a plinth area of 2,000 square feet or class 1; 2,225 sq. ft. of class 2; and of 2,670 sq. ft. of class 3.

Putting it the other way, suppose a building is to be constructed on a plinth area of 2,000 sq. ft.

- (1) With ground floor only, it would cost :
 (1st class) 2,000 sq. ft. \times Rs. 5 (constant) = Rs. 10,000.
 (2nd class) 2,000 sq. ft. \times Rs. 4-8 (constant) = Rs. 9,000.
 (3rd class) 2,000 sq. ft. \times Rs. 3-12 (constant) = Rs. 7,500.

(2) With two storeys (the ground floor and the first floor):

(1st class) $2,000 \times 5 + 2,000 \times 4-12 = \text{Rs. } 19,000$

(2nd class) $2,000 \times 4-8 + 2,000 \times 4-4 = \text{Rs. } 17,500$

(3rd class) $2,000 \times 3-12 + 2,000 \times 3-8 = \text{Rs. } 14,500$

Some times the rough cost is determined on the cubic contents of the building. For this purpose verandahs are supposed to be like rooms and the solid contents of the house are found out by multiplying the plinth area by the vertical height of the building from the ground level to half way up the roof.

This method of finding out rough cost is more accurate than that based on a rate per square ft. of plinth area, especially if the heights are measured from the bottom of foundations, as it takes into account the depth of foundations, the heights of plinth and floors, and the pitch of the roof. But it requires more time for making calculations.

In the case of terraced or flat-roofed houses, the height should be measured up to the top of the parapet walls.

The rates thus arrived at are:—

			Rs.	as.	ps.
Class one	...	...	0	5	0
Class two	...	...	0	4	9
Class three	...	...	0	4	8

Note:—It is worth noting that the bigger the sizes of rooms of a house, the lower is the incidence of cost and inversely, the smaller the rooms the greater is the cost per sq. ft. For, if a house, say

a chawl for instance, has got small rooms, the number of walls is greater, and with it, that of windows and doors is also more. The latter, in particular, go to increase the cost. Again, a reduction in areas of certain rooms does not always mean a proportionate reduction in the cost, because the number of doors and windows is not reduced; it remains the same. Hence to reduce the cost, a whole room or rooms must be omitted.

Economy.

Whether rich or poor, a man always likes to see his house built with economy. In fact, it is the social duty incumbent on everyone who wants to build a house, to practise economy wherever it is possible to do so. On the contrary, it is economically criminal not to do so. However, it should never be carried to excess so as to weaken the structure. A strong and solidly-built structure proves to be cheaper in the long run. Only the rich can afford to pay the heavy maintenance charges of cheap and jerry-built structures, which is not possible for ordinary people. Economy must really begin even from very trifling things. A trifling, saved in thousand items, goes to make up a big amount. Below are given a few hints on how to practise economy :—

(1) The more the dimensions of length and breadth of a house approach each other, the less is its cost. In other words an approximately square building is cheaper than an oblong one. To illustrate this, take the simple case of two houses, one measuring 80 ft. \times 20 ft. and the other 40 ft. \times 40 ft. Supposing the walls of both are of the same thickness (say 18 inches) as also the height of both is also the same viz, 20 ft, and taking only the outer walls, to simplify matters, the masonry of the first house is roughly :—

$$\text{Long walls } 2 \times 80 \times 1.5 \times 20 = 4,800$$

$$\text{Short do } 2 \times 20 \times 1.5 \times 20 = 1,200$$

and that of the 2nd,

$$6,000 \text{ cft.}$$

$$4 \times 40 \times 1.5 \times 20 = 4,800 \text{ cft.}$$

Thus the masonry of outer walls only of the first house is 25 p. c. more than that of the 2nd.

Moreover, there are certain special advantages in a square house, over an oblong one. e. g., a square house is cooler in summer and warmer in winter than an oblong one, because the latter exposes greater surface to the elements. The roof of the square house looks better and is simple and less costly to construct. 3rdly, a square house being more compact, the space occupied by corridors which are necessary for the preservation of the privacy of each room is much less in a square house than in an oblong one, and so on. All this is true up to a certain limit, beyond which, however, either open central chowks (yards) or small verandahs have to be provided for lighting the inner rooms, in which considerable space is lost; again, beyond a certain limit the height of the roof of a square house near the centre, and also the length of the hip rafters and in consequence, their section and cost, increase beyond economical limits.

(2) A storied building, having half the number of rooms on the ground and half on the first floor, is much cheaper than a bungalow or a ground-floor structure only, because the expense on account of foundations and roof for the storied building is nearly half that for the ground-floor structure. Similarly the expense for both on account of drainage channels on the ground and gutters below the eaves of the roof is the same. No doubt the staircase requires some extra amount and scaffolding and hauling up materials for construc-

tion to an increased height is more expensive; but the saving caused in foundations and roof is much more than this extra expense.

Again for a certain amount of accommodation, a ground floor structure requires a larger plot of land than a storied building. Where the site is very costly this consideration alone out-weighs all others. Besides, it is no small gain, particularly in crowded localities, that the rooms on the upper floor get a freer and purer breeze, which is a blessing in summer in a hot country like India.

This principle, however, could be stretched up to a small attic room or a low 2nd floor added on the top of the first, beyond which, the cost again increases, because the foundations and walls of a three or more storied building require to be of extra strength and hence they are more costly.

(3) For the middle-class people, there is no better way of effecting a considerable economy, than by restricting the height of floors. Ordinarily 8ft. or 8½ft. height is sufficient. It is in some houses kept 12 or even 14ft., which is not at all necessary. It is likely to be argued that more height means more cubic contents of air, which is no doubt true, but hygienically it is not the greater cubic contents of a room but the means provided for renewing the air by providing through ventilation in it, which is of more importance, for this, cross ventilation i. e. windows, in one wall for admitting fresh air and similar ones in the opposite wall for driving out the vitiated air, are required.

Another argument likely to be advanced in favour of larger heights of floors is that the build-

ing looks bold and prominent, but it should be remembered at the same time that the higher a building, the greater is the weight which its foundations have to bear and the more have its walls to resist the thrust of high winds. The artistic beauty of a building, in fact, does not depend upon its height alone but on the treatment of the proportions of its exterior parts towards each other.

By reducing the height of floor from 10ft. to 8ft. the saving effected in masonry is 25 per cent.

(4) It is not, however, advisable to try to effect economy by curtailing the height of the plinth. A high plinth contributes to preserve sanitation and health of the family and, hence, as far as possible it should not be reduced to less than 2ft. However 4 or 5ft. height of plinth, which is often times kept (unless it be in a damp locality) is a sheer waste which the middle or lower class people cannot afford.

Another means of reducing the cost of a building is to build the outer walls thick enough to protect the house from the heat of the sun and raids of thieves and to build all the inner ones of half or one brick thickness ($4\frac{1}{2}$ inches or 9 inches) with intermediate posts of wood or steel to support the weight of the upper floor or floors and roof. It is observed in a good many houses that 15" brick walls or many times 18" stone walls are built, where half or one brick partition walls could have very well answered the purpose. The main object of a partition wall is to afford privacy;

any extra thickness beyond that required for that purpose is, therefore, a waste.

(5) Local usage should be adopted, as far as possible. Maximum advantage should be taken of the material and labour locally available. e. g. if stone walls are insisted upon where stone is scarce and hence bricks are locally used, or if Mouhmein teak is insisted upon where good country timber is plentiful and cheap, the work is bound to be costly.

(6) Division of labour and specialization are great points in saving money, particularly when the work is being done departmentally. Masons who are used to dressing should be employed on dressing only, and those to setting, on setting only. An artisan of high wages should not be required to do the work of an un-skilled coolie. This is a very important point which is generally overlooked, e. g. if a mason getting Rs. 2 a day is employed on the work of pointing masonry joints, perhaps he may do even less work than young boys who usually do that work on a daily wage of annas 10 to 12 and who have specialised themselves in it. Another point to be borne in mind is, never to allow a highly-paid artisan to be handicapped for want of adequate assistance; e. g., for want of an additional woman-coolie getting 5 to 6 annas per day if a mason employed on Rs. 2 per day is required to do her work partly, viz: mixing mortar, carrying bricks, stones etc., two rupees, are sacrificed to save six annas. Similarly, a bullock cart is often engaged on Rs. 2 per day for carrying certain material; the cart-man

has to load and unload it, single handed. During the interval he is doing it the high waged cart has to stand still; and it is no wonder if the outturn is far less in comparison to the amount spent.

(7) A good deal depends upon the season in which the building work is commenced. In winter the days are short and it is not possible to start the work earlier than 8 A. M. Besides, the progress of work in the first hour or so is not satisfactory on account of cold. Again the work has to be closed by 5 P. M. as the labourers have perhaps to wend their way home before dark, thus with a respite of two hours in the noon the actual working period amounts to 7 hours where-as if the building work is commenced by about the close of winter from 7 A. M. to 7 P. M., the working period, with the same meal-time respite is 10 hours; thus a saving of 23 p. c. in the cost of labour or nearly more than 9 p. c. of the whole work is effected.

(8) If work is done expeditiously (of course, without un-due haste), it is done at a much less cost than if it is allowed to linger on. The overhead charges of establishment are less and the interest on the capital outlay during construction is less. Anticipate all likely difficulties and try to solve them early in good time. For this, it is desirable to chalk out a programme not only of the whole season, but also a detailed one, of every 2/3 days in advance and try to stick to it.

(9) If doors and windows are kept of one uniform width, the joiners who have to work on uniform sizes, find it much easier and finish it more

speedily. Again fewer centerings are required for supporting lintels or arches over them.

(10) It is usual to rake out joints of masonry and fill them again with lime or cement. By so doing not only is there a waste caused, of materials and labour but the structure is weakened, because it is not possible to make a good joint of fresh cement or lime, with the mortar which has already set; again the joints filled afterwards are likely to be neglected in respect of watering. The proper method is to rake out the joints when just fresh and fill them up with lime or cement; in this arrangement the mortar raked out is not wasted and the joints automatically get the water which is sprinkled on the masonry. A still better and the most economical way is, not to rake out the joints at all, but to finish them neatly in the first instance and rub them hard with a mason's trowel the next day, saving double labour and material thereby.

(11) Settle, once for all, the plan of the building, stick to it and never make any changes or alterations except under the advice of experts who will consider the effects of such alterations on the work already done, the extra cost involved etc. and guide you accordingly.

(12) Plain and simple architecture, not only looks well but is also very economical. Bay windows, ingle-nooks, too many corners in the walls, and too many breaks in the roof are bound to increase the cost.

(13) If it is intended to add another floor in course of time, it is advisable in the interest of economy to construct in the first instance, a flat or

terraced roof at an additional cost of about 12 p. c. of expenditure on the item of roofing. In that event the top of the terrace would ultimately form the floor of the upper storey and the parapets when raised would become walls. Nothing would thus be wasted, whereas, if a tiled roof is required to be dismantled for the same purpose, not even 40 p. c. of the material is found to be serviceable, all labour being wasted, besides.

(14) If the sinks, bath rooms and w. c.s are so placed that all the sanitary fittings come near each other, a considerable amount is saved.

(15) A considerable saving may be made by buying materials at the proper time and in the best market and by maintaining a continuous supply of them at the job.

(16) On small jobs, in particular, work could be done more cheaply by using what are called 'stock sizes'. For instance up to a span of 11 ft. or at the most 12 ft., steel joists of $4\frac{3}{4}" \times 1\frac{3}{4}"$ (w. 6.5 lbs. per foot run, are very cheap. If the span is increased even by 6 inches the next suitable size of joists is $7" \times 4"$ (w. 16 lbs. per foot run, which costs considerably more, even though its spacing is increased.

Selection of Site.

Two different view points, which are in principle antagonistic to each other, govern the consideration of this very important matter. The one is of a class of builders, who may be rightly called speculating builders. They do not want to build for their own use but for that of others, and therefore do not so much care for the internal arrangements and conveniences of houses as for the immediate maximum return on the capital outlay. Their tendency is to select a locality, which though unimportant and not much in demand at present, is likely to rise soon into importance. The sites at such places are very cheap in the beginning but when they develop they fetch amounts several times their purchase value.

For the benefit of these people it may here be suggested that such localities may take years to develop or in some cases may not develop at all. It all depends upon several factors not controlled or controllable by any one man or some times a group of men. It requires an uncommon shrewdness and keen foresight, which very few people possess, to judge those factors correctly. It is therefore advisable, because involving no risk from the investment point of view, to choose a street which has already developed. There, we know the situation in its reality. The class and sort of people inhabiting that part, the rental value of buildings obtaining at that place, whether the latter is increasing or decreasing, and so on. Thus though

the return may not be so great, it is a sure source of income. Again, from the point of view of investment, if the building is not required for one's own residence, it is prudent not to build on a commodious scale. If instead of building one spacious house suitable for one rich family, several small independent flats or cottages suitable for middle or poor class families are built, there are very few chances of losses resulting from empties.

The other view-point of looking for selection of a site is, for one's own residence or for that for a collective one—either industrial or cooperative housing. The considerations for the latter are slightly different which have been treated in the chapter on Cooperative Housing Schemes. Those which are common to both are given here. They are in respect of (1) physical features (2) soil conditions (3) sanitary requirements and (4) practical conveniences.

(1) The site should be on an elevated ground which is advantageous in two ways (a) the out-look is wider and brighter and (b) it affords facility of drainage. Particularly rain water flows away from the building as soon as it falls on the ground and the immediate surrounding area is left dry. A low lying site, on the other hand, is likely to be damp and unhealthy especially in the rainy season. A slightly rolling land is better than a monotonously level ground as it permits of less expensive drainage.

Rocky surface affords good foundations and also does not absorb any water but it gets hot by day and does not readily cool down by night

especially in summer. Again, if any excavation or levelling of site is necessary it presents difficulties. Laying of drains or excavation of gutters cannot be done satisfactorily except at prohibitive expense. Besides, it is not suitable for a garden or for growing trees.

Murum at surface with hard murum or rock within 3 or 4 ft. is the best soil; next best are gravel and sand. They easily drain off rain-water. But the possible rise of subsoil water level in them is an undesirable feature, unless the site is lying high. Besides, there is a danger of their absorbing impurities from defective drains, cess-pools etc. contaminating underground supply of water. Moreover sandy and gravelly soils tend to make the house hot. In this latter respect clay is better and if firm, gives a good foundation; but if it is black cotton soil, it is the worst in this respect, requiring special expensive treatment of foundations and subsoil drainage.

Trees grown in the neighbourhood, if thick, tend to keep the temperature equable and lend a charm to the landscape.

In the neighbourhood of the sea, the difference in the extremes of temperature is very small and there is a pleasant breeze blowing towards the land by day and away from it by night as the land gets hotter by day and cools sooner by night, than water. The sea breeze is very exhilarating as it contains ozone. But the air near the sea is always humid which induces perspiration causing discomfort, languidness and enervation as it is often very sultry and oppressive. There is another

disadvantage of sites in the neighbourhood of the sea, viz, the breeze which carries with it very thin spray of salty water acts upon iron and causes it to rust. Trees and gardens also do not flourish in the neighbourhood of the sea for the same reason.

From the sanitary point of view there should be no nallas, stagnant pools of water, old quarries, nor tanks and wells in a dilapidated condition in the neighbourhood of sites. If the wells are in a good condition with a copious supply of pure water, their existence adds to the value of the site.

The site should not be one on a reclaimed ground i. e. ground which was once a depression filled up afterwards with some animal and vegetable refuse. In the first place such a ground absorbs water, becomes waterlogged, and very often the stuff putrefies giving out foul gases, most detrimental to human health. 2ndly, there is always a risk of an uneven settlement of the foundation and all the dangers to the building consequent upon it,—a state which can be remedied only at a prohibitive cost.

A busy street which, though from a business point of view, may be desirable, is quite unsuitable for residential purposes, since the nuisance of dust caused by heavy vehicular traffic is positively harmful and the constant noise created thereby, deprives one of rest, especially during sickness.

Pens of cattle, cesspits, lime or charcoal kilns, tanneries, ginning factories etc. giving out smoke, foul odours and objectionable noises should be avoided even in a distant neighbourhood. Lofty

buildings and tall trees obstruct the breeze. The latter should be under one's control, so that they could be pruned or lopped off at any moment without trespassing on the rights of anybody else.

A good and sufficient supply of drinking water should be close at hand. In rural districts, it is an ideal condition to have one's own well. If it be a public one, its water must be beyond any chance of being polluted even at any future date.

From a practical point of view, the proximity is obviously beneficial, of a railway station (not very close as otherwise sleep is disturbed—a very important point in sickness), a public but not a very busy street, a Post Office, a Hospital, a Bank, a School and the Market. Of these it is absolutely necessary for the middle and lower classes to have the school not very far off.

It is necessary in the interest of permanent happiness of the family to have a good neighbourhood.

A free-hold site is infinitely superior to a leasehold one. Before finally settling the bargain, the legal aspect of the question should be scrutinised with the help of a lawyer.

It is advisable to make provision for an additional space of land, so that, it should be easy to add a wing afterwards to prevent congestion.

Orientation

Proper orientation means that setting or facing of the plan of a building, which allows the inmates of the house to enjoy to the utmost, whatever is good and to avoid whatever is bad, in respect of comfort in the elements of nature, such as, the Sun, wind and rain. Attention to this important factor, particularly in the tropical countries, is of great moment. The word "orientation" has been used here in a broad sense. It implies not only the direction of the main front of the house, but also the back and two side facings also.

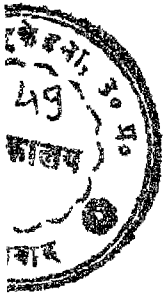
According to the Hindu orthodox principles a building should not, as a rule, face the South. But the wise men of old have provided an exception to this rule viz. that there is no objection to this, provided there is a house or a row of houses on the opposite side facing the North. In most of the western countries of Europe an aspect, which gives the maximum sunshine, is preferred. In those latitudes, the sun never goes over head i. e. is always to the south of the zenith. Besides, the climate of those places being very cold, the warmth of the sun is most enjoyable. Hence they provide for a southern aspect which gives them the maximum sunshine throughout the year. Here, in India and other tropical countries, what is sought for, is just the opposite. We want to devise means to reduce the sun's heat to a minimum especially in summer, when its rays strike us vertically or nearly so.

The Sun's action in causing heat is mostly direct by day. But by night it is entirely indirect.

Stones, bricks and tiles etc., of which the walls and roof of a house are composed, absorb sun's heat by day which they slowly radiate by night. While doing so the air in contact with them is heated which is the real cause of discomfort by night. Hence proper orientation must protect the house from both i. e. sun's direct heat by day and the indirect one by night.

Let us first consider the direct heat by day. The temperature of a place, though no doubt modified by several local influences such as, proximity of a sea-coast, hills, valleys and sandy deserts etc, or also by the elevation above sea-level, soil, vegetation and woods etc, is mainly governed by the latitude of the place or, which amounts to the same thing, the altitude of the sun above the horizon of the place. The mean daily altitude of the sun is highest in the tropics or the torrid zone and decreases as one goes either northward or southward towards the arctic or the antarctic zone. The total heat absorbed depends, again, on two factors (1) The intensity and (2) the duration. The aim of proper orientation, must be, to admit the required amount of sunshine into the house in the morning when it is very pleasant, and the intensity of its heat is less, and to minimise its duration in the afternoon and evening when its rays are again likely to enter the house. In the noon time the sun is generally overhead in the tropics and therefore its rays are not likely to enter the house.

The Sun's rays are potent to kill germs of diseases, but for that purpose severe heat is not necessarily required. The morning sun not only



does it satisfactorily, but lends cheerfulness in addition, coming as it does, after the chill and darkness of the night. The reason of it is, that there is full light, but very little heat in the morning sunshine. The cause of the less heat is three-fold: (1) The morning sun is inclined at a low angle with the horizon; its slanting rays, being spread over a greater area, bring to each square unit of surface less heat and thus diminish its effect. (2) Also, the oblique rays have to pass through a greater thickness of atmosphere which has already cooled down by the night, and again, (3) the air in the morning is charged with water vapour which allows the light rays to pass freely, but absorbs the heat rays in their passage. As the sun rises, its rays fall more and more vertically and heat becomes more and more concentrated. The moisture in the air also slowly disappears and the heat rays are less and less absorbed. In the afternoon and evening, even though the rays are again slanting, the air being dry, heat rays which are no longer absorbed, are intensely felt. That is why the evening sun is not so pleasant and charming like the same in the morning, and therefore is abhorred to a certain extent.

Thus we see that a certain amount of sunshine inside the house is not only desirable but is welcome. However, when we have just enough of it and it grows severe in heat, it should be shut off. Mere closing down windows for this purpose is not sufficient, because in that case, it will still heat the walls, and their radiation will make the rooms on that side quite uncomfortable. Hence we must so set or face the building that the sun's rays will be

effectually excluded without closing windows in the late hours of the morning, especially in summer.

By facing of the building is meant placing of such rooms on that side which are mostly occupied during the daytime.

If a certain amount of sunshine is allowed to penetrate into the house during early morning hours, it is bound to do so also a few hours in the late evening; to effectually exclude this and render it harmless, deep verandahs on the south and west side, have to be provided.

We have discussed above how it is possible to regulate the sunshine, but it is not the only factor contributing towards comfort. Air in motion or what is called breeze, and aqueous vapour or the relative humidity in the air are equally or perhaps more important than heat. It is the general experience that in spite of a low and equable temperature of sea-coast places, a still atmosphere which does not materially help evaporation, causes greater discomfort at those places, than a comparatively high temperature, in dry, arid plains, accompanied by a breeze. A high humidity causes perspiration and if the atmosphere be calm and still, which does not cause evaporation from the surface of human body, what is called 'sultriness', is the result.

The direction of the prevailing wind especially in summer, when it is most needed is between the West and South. The exact angle depends upon a number of local influences which need not be discussed here; to derive the maximum

comfort from this breeze, the bed rooms which are occupied by night must be located in its direction, but if they are directly exposed to the after-noon sun, they are heated and the radiation of their heat by night, as we have seen above, will warm the breeze and make the rooms hot and uncomfortable. Hence deep open verandahs both on the South and West are necessary.

To recapitulate, for proper orientation (a) place all the rooms which are usually occupied by day on the North and East and (b) place the bed rooms on the South and West and provide deep open verandahs to protect them from the heat of the after-noon Sun.

The Plan.

A number of varying factors affects the considerations of planning a domestic building. Hence, no very hard and fast rules could be laid down for general application. In the first place the plan must suit the configuration of the site, also its situation. For instance, the treatment required for a site facing the sea or river is bound to be quite different from that on an open plateau. No two sites could possibly have identical conditions. Individual requirements and idiosyncrasies, which could never be alike, lead to a number of varieties in it. The situation of the site, whether in town, suburb or in the country, plays an important part in the determination of the plan. That, again, differs according to the amount of accommodation required, by reason too of its alternative treatment whether a "detached", "semi-detached", 'flat', chawl, a cottage, or a bungalow and so on. Even in a town it may differ according to the street, neighbourhood, aspect, surroundings, also rental value and restricting by-laws of the local authority.

In spite of this variety certain features which govern the theory of planning are common to buildings of all classes intended to be used for residential purposes. They are enunciated below:—

(1) Aspect, (2) Privacy, (3) Prospect, (4) Grouping, (5) Roominess, (6) Furniture requirements, (7) Sanitation, and (8) Practical considerations,

(1) *Aspect*—By aspect, I mean the peculiarity of the arrangements of the doors and windows in the outside walls of a dwelling, which allows it to enjoy to the utmost, the gifts of nature such as sunshine, breeze, view of the landscape etc. This is a most important consideration in planning. It is a truth, universally admitted, that one's thoughts are moulded by the surroundings; outside influences play an important rôle in the development of the human mind. If they are pleasant and cheerful, people living in their midst are contented and happy; if, on the other hand, they are dull and dismal, they cast a gloomy shadow on their minds. It is, for this reason, those people of humble means living in small cottages, who stand most in need of the two factors viz, Aspect and Prospect.

A building must be designed to suit the site with all its varying aspects. Aspect not only provides comfort but is requisite from the hygienic point of view also. The value of sun's rays cannot be over-estimated. They are potent destroyers of organic poisons of spreading diseases and lend a cheerful and genial air to the rooms. With a careful disposition of windows, it is possible to admit sun's rays into any desired rooms. A kitchen should have an Eastern aspect so that, the morning sun would purify the air in it and it will remain cool in the latter half of the day; the bed rooms should have a S. E. or S. W. aspect; the drawing room, N. E. or S. E. and so on.

(2) *Privacy*.—This is next in importance in the design of domestic dwellings. If they lack in

this respect, it is a deplorable error which cannot be compensated for, by a host of its other merits. Privacy is of two kinds: (a) The one is in respect of screening the interior of any one room from the other rooms of the house and also from the main entrance, while, (b) the other is the privacy of the whole house from the high-ways and by-ways. The latter is comparatively easy to secure by carefully planning the entrance and screening it with trees or creepers trained on a trellis. But the former requires a careful thought in planning. The internal privacy of a domestic house could be maintained by (A) Proper grouping i. e. disposition of various departments and parts of the building in their relation towards each other, which, particularly in economic and compact planning, requires great skill on the part of the architect. (B) Proper disposition of doors. For instance, if a door is fixed in the centre of the shorter wall of a room, the interior of the whole room is exposed to view, whereas if it is fixed in a corner of the larger wall, the larger part of the room is screened. (C) The mode of hanging doors and (D) Provision of a small corridor or lobby. All these methods have been illustrated with concrete examples in the following pages in the notes describing various designs.

Privacy is of supreme importance in the following rooms in particular: bed rooms and all rooms in which sanitary arrangements are usually made such as toilet rooms, water closets and earth closets, urinals, bathrooms etc. The Kitchen department also should be kept out of the view of the passers-by. As far as possible every room except perhaps the

drawing room should have an independent access to it. Again, services such as bathroom, toilet and w. c. should have an independent passage to them from every room and the real skill of the architect lies in so disposing of the rooms with respect to the position of the services that a minimum space is occupied in these passages. This is called compact planning which is the very essence of economical designing.

Privacy is quite different from seclusion. The latter is sought to be secured in a worship room, study and library. A business man's or a manager's office is strictly private, though in the interest of business it cannot be located in a secluded corner; on the contrary it must be situated in a prominent place easily accessible to the public and situated in the centre of various departments.

(3) *Prospect*:—In its proper sense "prospect" has a reference to the impressions that the house will make upon a person looking at it from the outside. It connotes taking full advantage of the beauties of nature in the landscape by revealing to a stranger certain pleasant features and also by concealing from his eye some undesirable ones in the main outlook of the house. The sense of pride that one's house has got a smart, pleasing appearance and the effort to maintain it in that state which occupies part of one's time are potent factors in the amelioration of life of the poor who have otherwise continually to fight against odds and ends in life. Undue prominence, however, should not be given to this feature and it should not be the only or even the principal desideratum in designing

the elevation of domestic dwellings, particularly for housing the middle or poorer classes. Just a small projection here, a bay window there, casually provided to break the dull monotony at a small extra cost, which, considering the benefits it gives, is not only justifiable but necessary. This should not, however, be treated as an extra item in the estimate and considerable money spent over it. Bay windows not only fulfil this requirement but in addition, help in giving breeze and sunny aspect all the year round. Some of the forms of bay windows are shown below:—

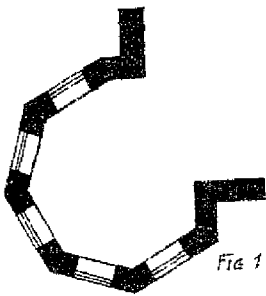


Fig 1

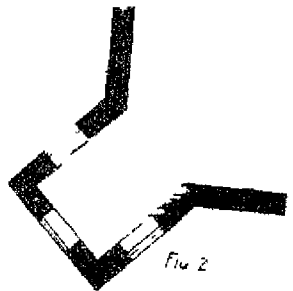


Fig 2

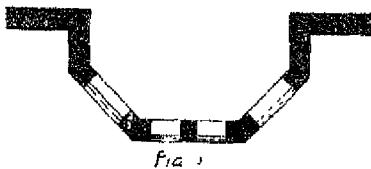


Fig 3

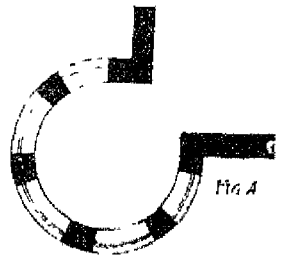


Fig 4

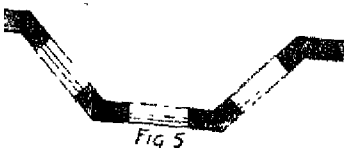


Fig 5



Fig 6



Fig 7.

Grouping:—Grouping means the disposition of rooms in respect of their relative positions towards each other. If a building fails in this respect no amount of care taken in all others, is of any avail. The dining room must be close to the kitchen, the latter, again, must be away from the drawing or main living room; otherwise, kitchen smells and smoke would detract from their usefulness. Services must be nearer to, and independently accessible from, every bed-room. The w. c. s., etc. must be far removed from the kitchen and dining room, and so on. This subject has been treated in detail later on in a special section under “grouping”.

Roominess:—Roominess is the opposite of crampedness. It has a reference to the effect produced by making the best of small proportions of rooms, by deriving the maximum benefit from the minimum dimensions of a room or to accomplish economy of space and at the same time avoid cramping of the plan. It looks so simple at first sight, but is really so difficult an art, that it often taxes the brains of the architect. A room whose walls are disproportionately high, looks much smaller than it actually is. Similarly, if the length of a room exceeds $1\frac{1}{2}$ times its width, it produces an effect of crampedness. A square room looks smaller and in respect of utility it is really so, as compared with an oblong one of the same superficial floor area. For example, if a small table is placed in the centre of a room, $10' \times 10'$, the small space equally divided on all its four sides is much less useful than the extra space left on two sides of it

in a room measuring $12' \times 8\frac{1}{2}'$ which has got practically the same area. Every square foot of the area under roof costs from 4 to $5\frac{1}{2}$ rupees. Hence the maximum advantage must be taken of every nook and corner of the house before thinking of making an addition to the plinth area. Plentiful provision of wall cupboards should be made; even the narrowest space under the flights of stairs should not be disregarded. It should be enclosed and turned into a useful store

: PLAN :
: Scale 2" = 1' :

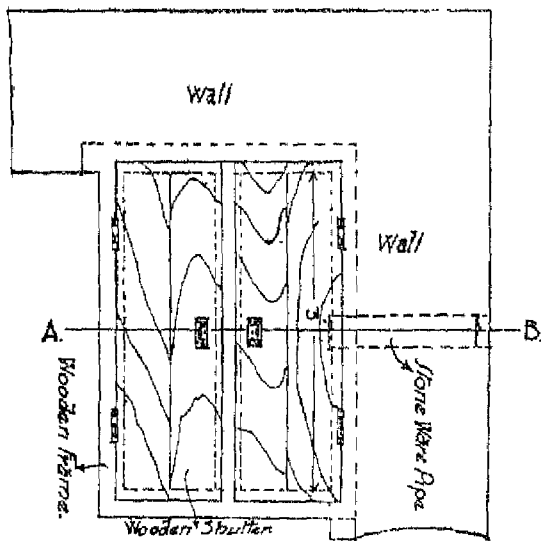


Fig 8.

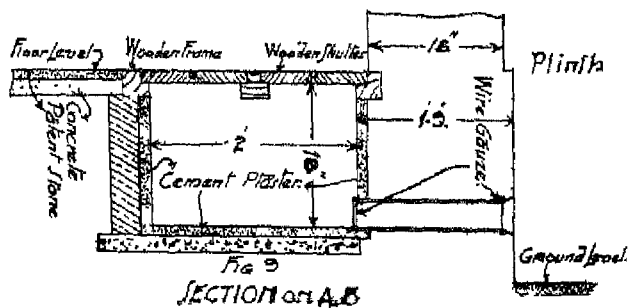


Fig 9
SECTION ON A.B

room. The space in walls below window-sills down to the floor level, could be used as a cupboard. This latter arrangement provides a cupboard at a very cheap rate, because no extra lintel or arch is required for this. A very convenient arrangement of an under-ground cupboard is shown in fig. 8 and 9. Provision of such conveniences together with one or two lofts below the ceiling in unimportant rooms and a few wall shelves supported on brackets, would render it unnecessary to set apart a separate store room in small cottages.

Furniture requirements:—This matter, though of a considerable importance is often most neglected. A bed room must be designed with due thought and attention to the prospective position of the bed. Otherwise the latter has to be cramped up somewhere in it, either in a position exposed to view, or opposite to a window facing a strong draught of wind. Even now, I can vividly picture before my eyes, a house of a friend, visited sometime ago, elaborately treated in respect of rich external decoration, in which a room was too small to accommodate a small table in the centre with sufficient elbow room all around it; another room could not accommodate a bed in any position without coming in the way of either a wardrobe or a window. It is best, therefore, to show in the plan the positions, not only of beds, but also of heavy pieces of furniture such as sofas, almyrrahs and chesterfield suites and even of pegs.

Sanitation:—Sanitation is of very great importance for a dwelling; because on it depend

the health and the happiness of the inmates. Sanitation embodies provision of ample light and ventilation and due attention to general cleanliness and sanitary conveniences.

Light—Absence of light has a deleterious effect even on plants, which, if placed in a dark room, soon lose their lustre and often times droop and die. People who have to work in mines, cellars and other dark places look pale and anæmic. This is due to the fact that light acts directly upon the corpuscles of blood which is made to flow vigorously with its natural bright red hue. Sun's light, not even direct but diffused, is found to be potent to destroy germs of tuberculosis. Hence too much stress cannot be laid on lighting the house as profusely as possible. There should not be a single corner in the whole house which is not sufficiently lighted. Particular care must be taken to light passages and stair-cases—the places where there are chances of collision and accidents taking place. As far as possible long and narrow passages which are difficult to be sufficiently lighted should be avoided. If they are at all unavoidable, sky-lights should be provided in addition.

Cleanliness :—This includes also the means provided for cleansing. In India water carriage and sewerage systems have developed only in a few big cities. There, it is comparatively easy to keep the premises clean, but in other cities and towns and in all rural districts this matter is very much neglected. In this connection the following extract taken from Dr. Poore's Rural Hygiene will be found to be very useful. In country districts every cottage ought to

have a bit of garden—about $\frac{1}{8}$ of an acre or more, and adopt the following system of sanitation:—

(1) “All excrement should be kept out of the drains; for, by doing this the putrefaction of the solid is prevented and the purification of the liquid by filtration through the earth is effected with ease, which is proportionate to the thinness of the fluid.

(2) All solid matter should be removed every day from the immediate neighbourhood of the house and buried in the top layer of cultivated ground. This surface layer is full of living organisms which rapidly disintegrate and oxidise any substance deposited in it, until in a very short time—in summer, within less than a week in tropical countries like India—the filth becomes fertile “humus” or mould. Household slops should be poured on to the surface of the garden and the mistake of attempting what is called subsoil irrigation must not be made.

(3) Earth closets with moveable pails should be outside the dwelling house, approached by a covered passage, with a cross ventilation. Sifted garden mould, taken from the top layer and dried in a shed—not by a stove—is most suitable for use. If specially constructed, as in Denmark, Sweden, and Norway so as to separate liquid from solid deposits and, if kept from household slops and other liquids, earth closets are, not only free from nuisance, but will provide valuable manure.

(4) With regard to other solid refuse, the rules must be—

(1) That whatever is capable of rotting must be put in a heap to humify.

(2) Whatever is not capable of rotting must be burnt.

(5) As for domestic slop water, it must never be discharged from the house below the level of the ground. The coarser impurities must be strained out by passing it through filter of gravel or cinders and in its transit to the filter bed it should be kept freely exposed to air in its entire course. If this is done, the exposure to air, sun, heat, cold and drying winds, hold putrefaction in check, and render impossible, the escape of foul gases into the house. The key to success is the separation, in every possible way, of solids from liquids."

Dust is a great enemy of health and its proper importance is not adequately understood in India. Most of the diseases are spread by it; hence, one should strive to minimise the chances of accumulation of dust and other objectionable matter. This could be done in the following ways:—

(1) No mouldings, even skirtings and cornices, should be allowed, particularly on the inner surface of walls. (2) Ledges, nooks, crevices and all unseen spaces which could possibly give dust a lodgement, should be avoided. (3) All edges and corners should be rounded. (4) Angles made by junctions of walls with floors and ceilings should be rounded. (5) Non-absorbent materials like glazed tiles should be provided in the w.c.s and kitchens for flooring and skirting all round of walls. (6) Trellis work in verandahs should have large apertures to facilitate cleaning, and railing of galleries and balconies should be of a plain and simple design for being easily cleaned.

Ventilation:—In providing windows for ventilation, particularly in chawls and flats, the habits of the people likely to inhabit them should be taken into account. Over-ventilation does no harm, while under-ventilation is full of it. Hence there should be a tendency to err on the safer side by providing more ventilation than absolutely necessary. In designing chawls and flats a provision should be made for sufficient ventilation even though the windows may be closed for fear of draught as is the wont of the people occupying them. This could be done by providing floor ventilators in the walls facing an open space. They should be about 18 inches long and 5 inches high, closed by fixed venetians or “hit and miss” sliding shutters as

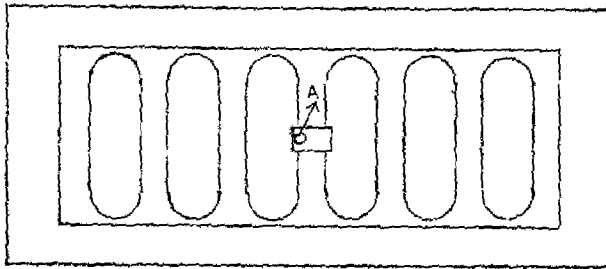


FIG. 10

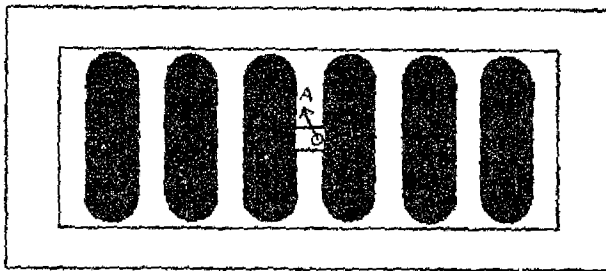


FIG. 11

shown in the sketch (see fig. 10 and 11). Whenever there is a high wind which is likely to cause an exposure to a man sleeping on the floor (which is the practice in many parts of India) the movement of

the button A, one inch either way, could partially or wholly close the apertures. In addition to these, ridge ventilators, near the ceiling, are required. For these, either bull's eyes or clerestory windows should be provided a little below the ceiling; or better still the main windows should be carried to within 6 inches or a foot below the ceiling. The theory is, that the lower strata of air in a room which are warmed by the human breath and to a certain extent by the radiation of heat from human bodies, and having become lighter by the warmth, rise to the top. Unless efficient means like windows near the ceiling are provided for driving them out, they are likely to cool down, become heavy again, and descend, and have to be breathed in again. They are injurious to health because, they are devoid of oxygen, which has been already used up.

Ventilation means much more than simply supplying fresh air to a room. It also connotes the evacuation of the vitiated air and the maintenance of a movement of air in the house.

For a thorough ventilation one large window situated in the centre of an outer wall is not sufficient, but there should be another window or windows in the opposite wall. Thus windows are necessary even in the interior walls for the sake of ventilation. The object of this arrangement is, that fresh air coming through the windows in the outer wall should travel across, from one room to another, through the windows in the inner walls and finally pass out through the windows in the outer walls on the opposite side of the house. This is called "through ventilation." In order that the air in every nook and corner of a room should be

renewed, 2 or 3 apertures distributed over the whole wall, exposed to an open space, are preferable to one large window fixed instead, on it.

The so called effect of "stuffiness" in a crowded room is caused not only by the partial exhaustion of oxygen and the presence of an undue amount of carbonic acid gas in it, but more by the fact that the human exhalations are warm and contain an amount of water vapour. They are, moreover, charged with microscopically small particles of organic matter (part of which also deposits on teeth) which gives foul smell. In addition to this the humidity and warmth, caused by the breath, induce perspiration on bodies of people occupying the room, which also adds to the stink and all these contribute to cause that feeling of 'stuffiness.' Hence the function of a satisfactory ventilation must be fourfold (1) to create a sensation of comfortable coolness to the body (2) freedom from bad smell (3) reduction in humidity and (4) proper supply of oxygen. All this must be secured without producing a perceptible draught.

The relation of window area to that of the room and the cubic capacity of space to be allowed per head are described while dealing with bed rooms under "grouping."

Practical:—The following few hints in connection with planning, would, it is hoped, be appropriate at this place.

(1) Strength and stability coupled with convenience and comfort, should occupy the first place of importance, and embellishment, the next.

(2) Simplicity and effect of strength lend lasting beauty and grandeur to a building which petty plaster mouldings and vain decorations do not. If a moulding is cracked or the edge of a corner knocked off, it is difficult to thoroughly repair it. Colours fade away and unless frequently renewed at a great recurring expenditure, the building on the contrary looks ugly.

(3) One should always bear in mind that a house is called an immoveable property and is calculated to last for several generations. One has, therefore, no right either to practise false economy and have a jerry-built structure which fast depreciates in value requiring continual repairs; or, on the other hand, build, under false ideas of dignity, a costly structure by incurring a heavy debt beyond one's means of repayment.

(4) In the years to come a man may perhaps have to add a wing or extend some part of the house. Provision for this should be made while building in the first instance, so that some part already built, may not be required to be dismantled at that time.

(5) Though a person is hale and hearty and perhaps in the prime of his life now, while building, he should remember that old age with its attendant infirmity, is sure to overtake him, and sickness, human flesh is heir to, may attack him sooner or later in course of time, as it always does in 9 cases out of 10. Hence it is always prudent to have one room preferably on the ground floor designed mainly for comfort which will be a hospital room

for the old and sick member of the family and in times of health and happiness, will prove to be a luxury. This question has been dealt with later on in this book while discussing "grouping" in the next chapter.

GROUPING.

In this chapter it is intended to take each department such as, drawing room, bed room, kitchen etc. separately and to discuss it in detail with regard to its internal conveniences and its relation to others. But before doing so, it would be well to take specific instances of Indian houses and to consider what accommodation is required in each case.

Let us leave aside the poor cultivators or men belonging to the class of an unskilled labourer, commonly called a 'Coolie'. These, on account of their abject poverty, have to be content with a small verandah and one room which has to serve them as a kitchen, a dining room, a parlour and a bed room, all in one.

Let us take the case of a lower middle class family, belonging, say, to a clerical or artisan class. The minimum requirements in this case are: a verandah, a kitchen-cum-dining room and two bed rooms, the principal one of which serves also as a parlour. People of slightly better means add a dining room, which is also a female apartment, and a closed bath room. People on whom worldly favours have shone still more brightly, require a drawing hall, a dining room, a separate female apartment, with one or two additional bed-rooms according to the number of members in the family.

The air on the first floor being undoubtedly much drier and purer than that on the ground floor, it is desirable to arrange all the bed rooms on the first floor and the remaining apartments such as kitchen, dining room, sitting room etc. on the ground floor. But in India people, particularly those belonging to the middle class, find it more convenient to have all the rooms on the same floor, as it saves them—particularly the ladies of the household—the labour of going up and down the stairs several times a day. Hence semi-detached houses with kitchen, dining, parlour and bath room on the ground floor and bed-rooms on the first floor, do not find favour in India.

It will be seen from the above that the maximum accommodation required by an Indian family consists of (1) a Verandah (2) a Drawing room (3) Bedrooms (4) Kitchen (5) Dining room (6) a Ladies apartment (7) a Store room (8) Worship or prayer room (9) a Bath room (10) a Staircase (11) a W. C. or a latrine.

Detailed discussion of grouping of all these rooms will cover the requirements of families of all grades of society.

(1) A Verandah.

A verandah or a loggia is almost an essential feature of an Indian home as it serves many purposes. Firstly, it is used for keeping shoes, sticks, umbrellas etc. directly as one enters the house; and also for storing prams and cycles. 2ndly, it serves the purpose of a waiting room for a stranger or a visitor before he is ushered into the reception or drawing room. 3rdly, it

serves as a passage giving an independent access to other rooms of the house, thus preserving their privacy. The fourth purpose is its use as a sitting out place in the evening or by night after dinner, enjoying some light reading or post-prandial talks with friends in a flood of cool breeze. In the cottages of people of humble means this is often the main sitting room. The fifth and the most important purpose served by a verandah is, that it protects the walls of the house on that side from being heated by exposure to the sun's rays. This it does in two ways: firstly, by sheltering or screening the wall from the sun's rays and 2ndly, by offering to them a buffer or a sort of cushion of air, which is a very bad conductor of heat. Thus the air entering the rooms behind it, is first cooled down to a considerable extent.

To secure comfort, verandahs on the South and West are indispensable, but if funds permit, they should be provided also on the East and lastly on the North. The latter is rather a luxury than a necessity. If exigencies of money do not permit to provide them on the South and West side, there should be one especially on that particular side on which the bed rooms require protection from the heat of the after-noon sun especially in summer. Not only are verandahs necessary on the ground floor, but also on the upper ones.

When a verandah is required only for mitigating the heat of the summer and not for the purpose of serving as a waiting room, an excellent arrangement is to have a cheap structure built of

wooden ballies or posts supporting a trellis above, on which is trained a vine creeper. The thick foliage which the vine gives forth in summer effectually excludes the sun and cools the hot breeze, and in winter, when its foliage is thin it allows the warmth of the sun to be freely enjoyed. The vine has a luxuriant growth and if well manured and trained it would cover the trellis not only on the ground floor but on the first floor also in a couple of years and would last for many years.

Verandahs are very often specially placed on the East or South-east and so designed, that they should be flooded with the morning sunshine and afterwards when the shutters are closed the sun's heat is, to a certain extent, 'trapped' inside. Such verandahs are called 'Sun-traps' and are most enjoyable in cold climate. The sun's rays have got the power to kill all noxious germs and give healthy and cheerful appearance and purify the air. For this purpose some times special "Sun-baths" are constructed in Western countries. Particularly in the first stage of tuberculosis sun-baths have got, it is said, a great curative effect on persons affected by it. In the latitudes covered by India the sun is very hot in the latter part of the day. However, a few hours' sun-shine in the morning, particularly in winter, is very pleasant. To take full advantage of such a sun-trap, the verandah should be protected by walls on the North and South and there should be windows on the East of the full height of the verandah, closed by glass shutters so that when sufficient sun-shine has been admitted the shutters could be closed.

If a verandah is designed simply for the sake of a passage or corridor giving an independent access to certain rooms, it need not be more than 3 or 4 ft wide. Any width more than this for this purpose is a waste. If, however, it is to be used as a sitting or waiting room, its width should be $6\frac{1}{2}$ ft. as a minimum, (although 7 to 10 ft. would be better), in which case one can conveniently spread a camp cot and lounge on it whenever necessary. Any intermediate width serves neither of these purposes satisfactorily and hence, is practically a waste. There is a disadvantage also from a deep verandah, in as much, as its roof is likely to darken the room inside and make it look dull and gloomy, unless rooflets (also called 'gablets') are provided. If the room happens to have one wall exposed to open space, it is possible to light it independently from windows in that side; but if it is a central one, the projecting low verandahs prevent it from being sufficiently lighted which is unavoidable. It is possible to cover the roof of the verandah with glass tiles, but it is both expensive and inconvenient from the heat point of view.

Projecting balconies, which are also a sort of verandah are useful, particularly, when opening from a landing of a stair case. These we see in many of the ancient public buildings such as the Gol Ghumat at Bijapur. After winding on a few steps when one has got a feeling of slight exhaustion, these balconies serve as a resting place where one can breathe fresh air and enjoy a view of the landscape, and are good in that respect. But when they stretch out from windows in private houses, particularly in an urban locality where

houses are not far removed from each other, they do not serve any better purpose than an additional relieving feature in the elevation of the building, which adds elegance to it. It also protects the room inside from the piercing rain, which purpose could be equally served by suitable bonnets over the windows. But this is secured at a sacrifice of considerable amount of money for a small doubtful advantage. From another point of view, they do a positive harm to our neighbours viz., they seriously interfere with the privacy of the neighbouring houses. No one would naturally like to be watched by his neighbours from a projecting balcony.

(2) Drawing Room.

Every cottage, whatever its size, should contain at least one spacious room, call it by whatever name you like, a 'drawing room' a 'parlour' or 'a main or living room'. To the Indian it is almost indispensable. Many and varied are the purposes served by it. It is mainly used as a reception room, as also for holding social functions. It is required to be used as a dining room on special occasions like marriage, feasts etc.; or on holidays when a number of friends are invited to dinner, the drawing room is required for boys and girls of school going age to study their home lessons. It is at times required to accommodate occasional guests who are never wanting in a middle class Indian family; It is also required as a congregation room on occasions of some religious discourse or some such festivities and so on.

The minimum size for a drawing room should be 15 ft. \times 12 ft. It should be well ventilated and lighted with large windows preferably starting from the floor level. The doors especially the one at the front and the other at the rear, should have a minimum size of 3' \times 6' so that pieces of heavy furniture could be easily moved in and out. The position of heavy pieces of furniture such as tables, almyrrahs, suites, sofas etc. should be invariably shown in plan and the positions of wall cupboards etc. should be accordingly fixed. This simple matter, if neglected at this hour, is likely to cause a great inconvenience afterwards.

As regards the position of the drawing room in an Indian home, it is best situated on one side in the house with an entrance from the front verandah. Amongst Europeans it is usually placed near the front door. In that position it occupies a central place which though convenient to the style of living of the Europeans, causes inconvenience in Indian families. It interferes with the free movements and actions of the ladies working in adjoining rooms. Amongst Mahommadan and other communities, where privacy in an exaggerated form, viz. Pardah, is still in vogue, the drawing room in a central position causes a positive inconvenience.

Mouldings of any sort, even cornices and skirtings on the inside of the drawing room, or in fact, of any room, to give a decorative effect should be scrupulously avoided as they present an ideal breeding place for germs of disease.

Very often, a wooden plank about 6 to 9 inches wide is fixed, flush with the plaster surface all round the drawing room, horizontally at a height of 3 ft. above the floor level and polished well. This is for protecting the plaster of walls which is likely to be damaged by the backs of chairs striking against it. A picture rail fixed about 9 inches above the level of the top of doors provides a means for resting picture frames. This serves also as a dividing line between the costly oil paint or distemper below, and the simple plain white-wash above, which arrangement is not only economical, but also pleasing to the eye and excellent from the sanitary point of view.

As far as possible, pegs should not be fixed into the walls at random. some clothing or other is bound to be hung from them which looks unseemly. If necessary, a set of a few pegs should be fixed to the wall in a corner for the purpose.

Often times the drawing room of the usual size proves to be too small on some of the special occasions mentioned above. To meet such an emergency, a double drawing hall is sometimes provided. For this, the partition wall extends a foot or two from each side, over which an arch is built. The space below the springing of the arch is closed by a moveable or sliding, thin, wooden partition which can be closed or opened at will, so that one big room could be made out of two. A partition wall could be safely built on the top of this arch on the first floor. If, however, additional safety is desired a joist may be placed on the top of the arch to support it.

A skirting of black japan, coal-tar or a paint of dark, chocolate or slate colour, a foot wide all round the wall above floor, not only looks well, but is sanitarily good and allows the floors to be freely washed with a disinfectant in water without staining the distempered surface.

(3) Bed Rooms.

These are the most important rooms in a house. One spends more than $\frac{1}{3}$ of his life at rest in sleep here. Amongst Europeans two persons are commonly supposed to occupy one room without constituting a case of overcrowding. Thus if there are 5 or 6 persons in a family they require a house with three bed rooms.

It is a pity, that on account of poverty and ignorance of the importance of ventilation, little or no attention is paid in India to this most vital question. In many places, especially among the poor classes residing in villages, the number of occupants of a bedroom is determined by the possible number of mattresses which could be spread on the floor from wall to wall in the room. Four, five, or even more persons are in the habit of sleeping in it. Of course, in many parts of India cots or charpois (four legged coir-matted wooden cots) are a luxury which even the middle classes cannot afford to enjoy. In farmers' huts, even young calves and dogs are allowed to occupy a corner of the same room. The one or two small windows (if such holes, in wall, deserve the term,) that there may be in the walls, are also closed for fear of draught.

* "According to the census report of 1921, there are 1,75,001 one-room tenements in Bombay, giving an average of 4.03 persons per room and no less than 65.8 per cent of the population live in one-room tenements !

Many of the rooms are occupied by more than one family ! The rent of these rooms is from Rs. 10 to 12 per mensem; the average monthly wages of this class is Rs 30 per mensem. The result of all this could be very well imagined. The low vitality, the very high death-rate, anæmia, tuberculosis (particularly in females) and high infant mortality etc. are all directly traceable to the overcrowding in bed rooms. The farmers, who have to work all day in the open field, get pure air by day and thus have got this relieving feature partly to compensate for the overcrowding in bedrooms by night. But the mill hands and other labourers who have to work the whole day in an atmosphere congested with smoke, and who do not get a chance to breathe in free air also by night, fall an easy prey to diseases. In old times, Agriculture was the main industry of India, which required the majority of people to do work in the open air, and that preserved their health. In this industrial age, people are leaving agriculture behind them in the villages and flocking to industrial centres in cities, which have attracted large numbers even from the middle classes who follow pursuits of clerical or other allied nature. Males go out of doors during at least a part of the day, but females have to spend all their time at home doing domestic work, which has resulted in lowering the

* Sanitation in India by Turner and Goldsmith p. 261

general standard of vitality amongst them. It is futile to expect that the children born of such mothers who are the future citizens of India, would be strong and healthy. Therefore, if India wants to live amongst the nations of the world, she must solve this problem of housing the middle and working classes satisfactorily, and the sooner she does it, the better.

The minimum window area, required by the municipal by-laws, is $1/10$ of the floor area. But this should always be exceeded. In domestic buildings a minimum of 350 cubic ft. of space for an adult and 200 c. ft. for every child under ten, should be made while designing bed rooms. Besides this, a suitable allowance should be made for every piece of furniture. However, the quantity (square ft. of window area) and quality (cross and through openings) of ventilation is of greater consequence than either the floor area, or the cubic space allotted per head.

The above considerations will give some clue to the sizes of bed rooms. From a practical point of view $15' \times 12'$ has been found by experience to be a good size for a bed room in the houses for the middle classes. As has already been stated, an oblong room is more convenient, particularly as a bed room, than a square one and that no room should be less than 100 sq. ft. in floor area.

Bed rooms should be placed on the side of the direction of the prevailing wind and if this happens to be the west, the wall on that side should be protected from being heated by the sun's afternoon rays by the provision of a deep verandah on that

side. The ideal conditions are, that the sun should shine in the bed rooms for some part of the day, preferably in the morning, and a free breeze should ventilate it by night.

A small bath room combined with a dressing room attached to bed room, is more or less a modern necessity in the houses of the well-to-do. However, in small cottages, it is desirable to so arrange the bed rooms that the services viz, bath room and the w. c. are easily and independently approachable from every bed room. In the designs given in the following pages, a special attempt has been made in this respect.

(4) Kitchen.

If the room for the kitchen is a spacious one, there is no need of a separate scullery for the Indian manner of living. As far as possible, the kitchen should be in a separate block cut off at least 10 ft. by a covered passage from the main building. However, with this arrangement it is not possible to keep an eye on strangers entering the front door. Besides the ladies feel the isolation of their sphere of life (wherein they practically spend their whole time,) from the rest of the household, and sometimes resent it.

For the Indian manner of living, especially in the cottages of the poor, there is no necessity of a separate dining room if the kitchen is a little more spacious. For this purpose the room should be rather oblong; 10' x 15' to 18 ft. is the best size. The length should be at least $1\frac{1}{2}$ times the width, so that, the actual portion used for dining is far removed from the heat of the chulla range.

There should be as many wall cupboards and shelves in the kitchen as could be accommodated without interfering with the strength of the walls. One of them viz. that for the larder should be situated in a cool corner and should have shutters of perforated zinc or fine wire meshing with "air bricks" behind, for a thorough ventilation. This would be useful for storing milk and its products such as curds, butter, ghee and the like.

There should be at least two windows with half glazed and half perforated zinc plate shutters—one for lighting the chullas and the other for lighting the other part of the room. The provision of half shutters of perforated zinc sheet or fine wire meshing is necessary for the purpose of ventilation and prevention of flies entering the kitchen. Flies are vehicles of disease germs and must be vigilantly guarded against, by making suitable provision for the purpose.

The chullas should be located below an arch 4 ft. wide, 1' 9" deep and 3 ft. high at the centre above the floor level. There should be a hole about 8 inches in diameter at the top of the arch as an outlet for the smoke. This hole should be plastered smooth on the inside while still the masonry work is in progress. This should end at the top in a chimney which should be carried at least $2\frac{1}{2}$ ft. above the ridge.

There should be a small sink near the chulla in the opposite corner with a *Nhani-trap* fixed in its bed. The bed and sides of the sink should be lined with glazed tiles or polished shahabad or katni slabs and if that is found to be too costly the sides should be

lined with cement plaster and the bottom with a whole shahabad piece with a good slope in the corner towards the Nhani-trap.

The kitchen should be placed as far as possible in the corner opposite to the direction of the prevailing wind. In the Deccan, the North-east corner is found to give the best results and South-east the next best, the object being, that the smoke and strong smells emanating from the kitchen, should at once escape out of the house through windows in the outside wall, instead of escaping into other rooms of the house. As an additional precaution towards the latter end, the kitchen should be separated, if possible, by a small lobby; and the doors opening from the kitchen into other rooms, should have no ventilators or fanlights, so that when these doors are closed the kitchen smells are effectually shut out from the living rooms of the house.

(5) Dining Room

If the kitchen is sufficiently spacious, even a verandah on the rear side closed with a dwarf wall 3 ft. high and a trellis work above, will serve the purpose of the dining room in small cottages. When a separate dining room is to be built it should be located as near the kitchen as possible. Provision of one or two cupboards and a few 1/2 inch galvanised iron pipes, galvanised steel wires or at least long bamboos fixed horizontally in wooden blocks fastened to the opposite walls a foot below the ceiling, for drying wet linen, make the arrangements in the dining room complete.

(6) A Ladies' Apartment

This room is a necessity in an Indian family. Ladies do require a separate sitting room to receive their friends and enjoy spare time chats with them. This room also should be airy and well lighted and should be situated near the dining room. In humble cottages, the dining room also serves as a ladies' apartment.

(7) Store Room

This room also is a necessity in houses for the middle classes. In very small cottages roomy wall cupboards and a loft, either in the kitchen or in the dining room, serves the purpose of a store room. One or two underground cupboards (described on p. 40) would be very much appreciated in small cottages in particular. The store room should, as far as possible, be situated near the kitchen and should have a stone paving so as to preclude the possibility of rats entering and making their home there. Rats, not only, do a lot of damage, but also carry on their body, the potential danger of fleas affected by plague. The store room should be well lighted and ventilated and there should be a row of shelves all round. The lowest row should be at least 9 inches above the floor level so that the floor could be easily cleaned and washed of all dust. For an ordinary family a store room of about 10 ft. x 6 ft. should be adequate enough.

In rural districts a bigger store room is required to store staple food grains etc., which are available at a cheaper rate during the harvesting season. Besides a fuel room or a coal cellar spacious enough

to store fuel sufficient for the requirements of 4 months of the monsoon season, is required in addition.

With large families there is always a heap of lumber which though not quite useful, cannot be thrown away. One of the rooms of the detached out-buildings should be devoted to this purpose.

In addition to this, some space for putting bicycles or a perambulator is very often required in the cottages of the middle class people. The space below the flight of stairs is suitable, if the latter be situated not far from the front entrance.

(8) Worship or Prayer Room

Of late, very few people can afford to devote a special room for this purpose especially in cottages in the urban area, for many reasons. The chief amongst them is, that one finds very little time for this purpose in the midst of a modern busy life. 2ndly, the space is very much restricted and thirdly, there is a want of funds for building on any more area that what is absolutely necessary. In the up-country places all these things are favourable. There is any amount of leisure; site is unrestricted in extent, and the building materials and labour are comparatively cheaper. If a provision of this room is desired, it should be situated in a secluded part of the house, free from disturbance of any sort. It should be well ventilated and lighted, but there should be an arrangement to make the room partially dark when required. Slight darkness particularly combined with seclusion tends to

increase] the solemnity which is very much desirable in this room for inducing concentration of mind.

(9) Bath Room

The main bath room should be on the ground floor and near the kitchen. If a hot water boiler is to be kept in the bath room a minimum size required for it, is 6'×10'. If used only for bath purposes 5'×8' is a sufficient and convenient size. There should be two windows in a bath room—one for ventilation, situated at a height of 5 ft. above the floor level and another at a low level with frosted glass shutters for admitting light but maintaining privacy. It is convenient in small cottages to keep the height of the bath room low (say about 7½ or 8 ft.) and to provide a loft above it for storing fuel or any other articles of lumber. The loft should be well lighted and ventilated and it should have a hinged door of expanded metal to keep rats out.

The Indian way of taking a bath requires some part of the floor say 3'×3' preferably that in a corner to be lowered in level by about 3 inches than the remaining and a smoothly dressed stone 18"×18" and about 6 inches high, fixed in the centre for squatting, while taking a bath. The entire floor of the bathroom and the inside lining of the wall to a height of about 4 ft should preferably be of white glazed tiles, or, if its cost be found to be prohibitive, the floor should be paved with Shahabad or some other kind of slabs and the sides with cement plaster. As far as possible lime in the form of mortar or calcareous composition of

flagstones, should not be allowed at least in the sink or the lowered part of the floor, as urine, which contains an acid, acts chemically on the calcareous matter, and unless copious water is poured for flushing immediately after use, it causes a bad stink and wears the stone away. Even trapstone paving is preferable in rural districts, though from a sanitary point of view a smooth surface cannot be given to it so easily. A Nhani trap should be fixed in the bottom of the sink towards which the floor should slope. In no case should the water be allowed to stagnate near the house. It causes not only damp, but also breeds mosquito-larvæ.

The provision of a corner—shelf at 5½ft for keeping a soapbox, a towel rack, another corner-shelf 9 inches above the floor level with perforations for draining off water from wet and soiled linen and a shower-tap, if feasible and necessary, make the arrangements in the bath room complete.

Whether water is heated in a boiler or in an open copper pot placed on a chulla, a smoke-outlet is a necessity; still to preclude the possibility of the smoke entering the house, the main bathroom should be located in a place opposite to the direction of the prevailing wind and should have no ventilators over the doors opening into other rooms from the bath room.

Though a bathroom attached to every bed room is a luxury which only the rich people can afford, there should be, in addition to the main one, a common bathroom, which guests and other occasional visitors, could use without encroaching upon the privacy of the family. If bed rooms are

located on the first floor, there should be a bathroom equipped in all respects, also on the first floor with an independent passage to it from each bedroom.

(10) Staircase

The staircase is the main thoroughfare of intercommunication between the floors and as such is of very great importance. But generally there is a tendency with people, of effecting an economy of space in this particular respect at a sacrifice of considerable comfort. If the upper floor is exclusively devoted to bedrooms, the staircase could be located at any convenient place inside the house. But if some of the rooms on it are to be used as sitting rooms as well, which outsiders may occasionally visit, the position of the staircase must be such as will afford it an entrance independent of the other rooms on the ground floor. That is why many people like to post it in the front verandah. If it is situated in the latter place, another staircase on the rear side, for the use of the ladies, will add much to the convenience and privacy of the household.

In order that a staircase may be comfortable it must satisfy the following requirements:

(1) It should be airy and well lit.

(2) The stairs should be easy and comfortable. There are two rules for guidance to determine the mutual relation between the tread and riser: one is,

$$\text{tread} \times \text{riser} = 66 \text{ inches}$$

and the other is,

$$\text{tread} + 2 \times \text{riser} = 23 \text{ to } 24 \text{ inches.}$$

Note:—The limiting dimensions are, that the riser should never be more than 8 inches and the tread less than 9 inches. 6" riser and 11" tread are very satisfactory dimensions; 6½" and 10" are next best. These will be appreciated by old people and invalids who find stairs in general difficult to negotiate.

(3) There should be at least 6½ ft clear headway above any step.

(4) The width of the stairs in a winding flight should be the same as in the straight one.

(5) The stairs should be sufficiently wide (3½, if not 4 ft.) so that two people should be able to stand abreast comfortably and pass by each other. It also easily permits pieces of heavy furniture to be carried to upper floor. This precept, however, in Indian cottages, is honoured more in the breach than in the observance. 3 ft is the minimum width required even in the smallest cottages.

(6) As a rule a staircase should not have triangular or winding steps at all. Not only do they tax the ingenuity of carpet layers, but they cause a positive harm. Firstly, people going down the stairs are much more likely to slip on the "winders" than on the stright steps and, secondly, if they slip they fall down a large number of stairs which is likely to make the fall a serious one. Young children are very susceptible to this in particular. It is therefore prudent to leave no chance for possible risks by spending a few rupees more and altogether avoiding winders *even at the sacrifice of an easy riser*. If for exigencies of

space they are unavoidable, they should be at the beginning of the flight near the ground, so that, if a fall does occur at all, it should not be a severe one.

(7) As far as possible the height of the risers should be uniform. A difference of even $\frac{1}{2}$ inch in the height of one single step, though not quite apparent to the eye, is at once susceptible to one's legs and causes one to startle and stumble.

(9) Each flight should have not less than three steps at least, and as far as possible the number of stairs in each flight should be uniform.

(10) The staircase should, as a rule, be fire-proof, especially if there be only one.

(11) Not more than 10 steps should come together in one flight. But this is not always possible.

(12) A staircase just in front of a house gives a poor appearance. Aesthetically a geometrical staircase (one having three or more flights at right angles to each other) is good. It also affords easy facilities for lighting and its "well", or the central hollow portion, forms a good position for a lift. But it involves a danger in case of an outbreak of fire, as it provides an air chamber and a sort of chimney which causes the conflagration to spread. Moreover, it totally blocks the descent under those circumstances.

In flats and tenement houses in particular, unless there is a separate emergency exit, the staircase should necessarily be fireproof.

Comfort Room.

You may be strong and stout, and your entire family enjoying excellent health, now, at the time of building your house; but you should not lose sight of the rainy-day too. There is every chance of yourself or some one of your family falling sick, some time in future. Again, it is likely that there might be some aged or an infirm person in the house dependent on you—why, you yourself cannot escape old age in course of time. Hence, it is prudent to have in view one room mainly designed for comfort of the aged and the sickly, which can be properly called a "hospital or a sick room", but at the time of building a new house in the expectation of health and happiness, the word may sound rather inauspicious or freakish, hence, to follow M. Coule and make it *suggestive*, let us call it a "Comfort Room." For being really comfortable, it should satisfy the following requirements :—

(1) It should preferably be on the ground floor to save the sick or the aged person, the troubles of going up and down the stairs. If there be any lift for the purpose, then the 1st floor, which is healthier, is preferable, still there should be an easy staircase without any winding steps, for use in times of a possible break-down of the lift.

(2) A bath room, and a w. c., where there is a water carriage system, or a commode arrangement where there is a conservancy system, should be quite close to it, preferably in an ante-room.

(3) The room should be so situated that it will be flooded by the morning sunshine, and will also get

a free breeze by night. A south-east corner would be appropriate for this reason, with a verandah on the South.

(4) In the cottages for the middle classes it should not be far removed from the kitchen, so that it should be possible for the ladies to attend or render prompt service especially to the aged who are not in need of a constant attendance. Still, it is advisable to have another room, close to the comfort room which an attendant could occupy.

(5) There should be windows for ample light and a thorough ventilation, with blinds for obscuring light whenever necessary. Some sick persons find strong light unbearable.

(6) The room should be rather commodious; 15' x 12' is a good size, but that depends upon the size of the cottage to be built. The floor should be of such material as will permit of easy washing and cleaning with a disinfectant.

Architectural Treatment

"Architecture is the material expression of the wants, the faculties, and the sentiments of the age in which it is created. Style in architecture is the peculiar form which that expression takes under the influence of climate and materials at command"—Ellis A. Davidson.

As we expect in all truthful matters that the outward forms and shows should correspond with the inner feelings and emotions, otherwise we condemn it as insincerity, so in buildings, too, an artistic elevation should be accompanied by a convenient and comfortable accommodation of plan. Hence, while planning buildings attention must be given simultaneously to both these things. The proper course is, to plan the inside arrangements first, with a view to comfort and convenience, and then to give it an architectural expression to suit. The former is more difficult to accomplish; the latter is comparatively easy, only if one is prepared to ignore the restrictions of his purse.

"Construction should be decorated. Decoration should never be purposely constructed. That which is beautiful is true. That which is true must be beautiful"—Owen Jones.

If we see the origin of the beautiful features in architecture, we shall find that most of them, if not all, were originally introduced to serve some necessary useful purpose. For example—the projecting cornice of the window sill or the string

course at floor-level of the upper story was first introduced to prevent rain water running down the outer surface of walls from entering the house. The *chhajjas*, for mitigating effects of heat and the glare of the sun, and also to serve as a weather board; the arch, because of its strength to resist the superincumbent weight; latticed *jalis* (pierced screens), for protection from heat, and so on. Therefore every architectural feature must justify its existence from the point of view of utility.

It is a pity, however, that in actual practice, in the enthusiasm to show an artistic taste, undue importance is given to the outward expression of beauty and large amounts wasted on vain decoration. This is often done even at a sacrifice of internal conveniences. If comfort and conveniences have to be compromised for the sake of architectural appearance, it is not a decoration but an abomination.

What is it that constitutes the charm and attraction in an elevation? What particular factors or features contribute to give pleasure to the eye and joy to the mind? To be able to give a correct answer we must pause a little to reflect on the effect produced on our minds by the sight of a beautiful object. If we cast a glance, for instance, at the famous *Taj* or any other beautiful structure, a sensation of pleasure is caused in our minds and at the same time a permanent indelible impression of the object is created before our minds' eye. Now, if we just analyse the impression or the picture before our mind, we shall find that it consists of the general outline of the structure, seen in one general

colour harmoniously matching with the surrounding landscape. The various colours with which it is decorated cannot be seen from a distance and are not individually responsible for the impression. Nor can even the carving, and other ornamentation have any effect on it, because they are too numerous in detail and have to be studied at close quarters to be properly appreciated. Thus, it is the general outline—the bold and clear-cut features of the structure, seen in the landscape, which have imprinted themselves on the mind.

This clearly shows the folly of spending money lavishly on vain embellishment which serves no good purpose, but on the contrary as seen on page 44 from a sanitary point of view, does a positive harm by affording a lodgement for dust. The style and form of the building, which determine the outline, are the real things that count and have to be attended to.

The style of the plan in old times was of one set, stereotyped form, and that was chiefly concerned with a symmetrical front. Of late years a school of architects has arisen who are not satisfied with symmetry. They have widened their field of choice, and they lay their plans on principles of irregularity, quaintness and surprise. Symmetry does not attract their eyes. Their argument against it is, if symmetry was first introduced with a view to copying nature in which all human beings and in fact, most animals present a symmetrical front, then why not carry the principle a little further and design symmetrically also the inside of the buildings? Because if a

median line is imagined in animals, the functions of all the members on the right side of the body are similar to those on the left, perhaps with a few exceptions. Again, leaving aside the animal world, if we observe the plant life, we find that Nature, on the contrary, is distinctly opposed to symmetry. The tree sets forth branches at random, take any flower and you will find no two petals to be alike. Thus, from the view point of this school of architects, that elevation of a building is smart and attractive, which brings into bold relief, certain features which though seemingly irregular, come as a surprise. Of course, this must all be in keeping with the basic principles of architecture or in fact of all decorative art viz. fitness, proportion and harmony, the combination of which give repose as a result.

Such deviations from the usual order of symmetrical fronts are shown in a great variety in the elevations given in the pages that follow.

The character of the building must harmonise with the surrounding landscape to give it an effect of repose. If, for instance, the site slopes steeply give the building a vertical treatment. If it is a flat plateau of open country, let it have a character of breadth. Vertical treatment consists of a high plinth; thin, tall pillars; narrow, pointed arches; narrow windows; high-pitched roof, etc. The broad or horizontal treatment on the other hand, requires a massive appearance with broad low steps; massive and comparatively short pillars; broad and low windows, with lintels, or flat or elliptical low arches; flat, terraced or broad, expanding low-pitched

roof; and so on. As another instance, if, on the top of a barren rocky hill, a building with plaster mouldings is constructed, it is sure to cause a discord. What is required in such a place is a structure of massive rustic stones, having bold, clear-cut features.

Though harmony must predominate to give an effect of repose, there must be a variety, or contrast without which harmony is sure to produce an effect of dull monotony. In fact, while trying to bring about harmony, with the beauties of landscape, what we can at most do is, to approach nature particularly in respect of tints of colours. It is impossible to produce colours exactly similar to those of Nature. Hence in imitating Nature we remove the discord and come closer together towards it, but not merge into it.

The contrast, however, must not be so striking as to be painful to the eye. What is required is a "harmonious contrast" which makes the features maintain their individual impression and still do not produce a discord.

This harmonious contrast is more applicable to, nay, is the very essence of, the effect produced by different colours. If a colour wholly merges into another it cannot be seen at all. In order to make itself distinctly visible it must have its own individual shade contrasting against that of the back-ground, but not at the same time producing a jarring effect in its association with the surrounding colours.

The common error made in the development of the modern elevation of buildings is the eclectic

tendency, i. e. to say, the mixing up of several heterogeneous things to produce something which neither belongs to this, nor to that particular order. The main characteristics of the Indian architecture lie in the breadth and horizontality. If we just cast a glance at any of the ancient monuments, we will not fail invariably to see everything massive and comparatively low in height, - horizontal lines predominating to produce an effect of breadth in the whole structure. The cornices or string courses dividing different floors; projecting galleries; verandahs; terraces open to sky with parapet walls all around; pierced screens or latticed windows; chhajjas; flat arches; etc. are matters of pure Indian Architecture. Sash windows, protruding small porches, high-pitched or mansard roofs, slate covering, high extending chimneys, in most cases symmetrically placed, stucco-plaster, dormer windows, are features of the English Architecture.

The predominating material used has a direct bearing on the elevation of the building. A stone building gives an effect of strength; and especially if the stones are massive, that of grandeur; while a brick building particularly if it is plastered and coloured on the outside, gives an effect of delicacy. There should be one predominating material and colour, and not a jumble of too many materials and too much detail. Every quaint little bit must justify its existence.

Large areas of plain wall, proper disposition of doors and windows in the outside wall, harmony of colours of the parts of the building with that of the

structure, and of the latter with the surrounding landscape, are things which consider-
 act the beauty of the building.

ditional effect, if desired, could be obtained
 ng slight deviations from the simple square
 The simplest form is L shaped, which
 gives a better appearance, but is also
 nt and comfortable in tropical climate.
 rms resemble the letters T, H and U, each
 hich has got its own peculiar merits.

ecting one part of the building a little

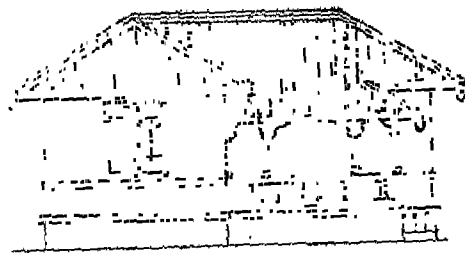
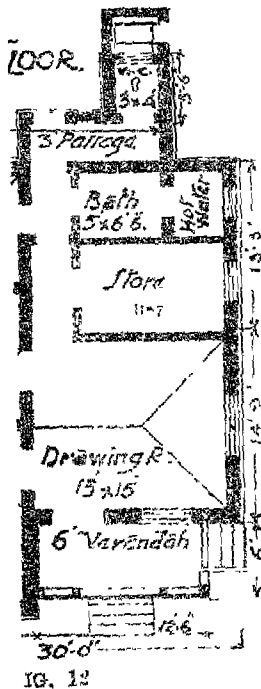
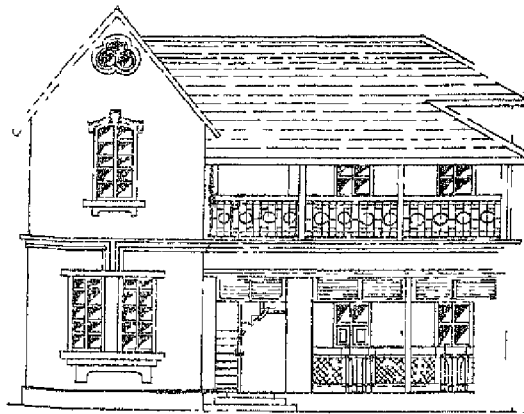


FIG. 13

he rest (see fig. 12) gives an additional
 tabled roof is generally constructed over



FRONT ELEVATION

Scale 1/16".

FIG. 14

such projections (see fig. 14), but even a if properly constructed as in fig. 13 give of repose. This arrangement far outw little extra cost involved in the projection

Sufficient mention has been already

FRONT ELEVATION

Scale 1/16"

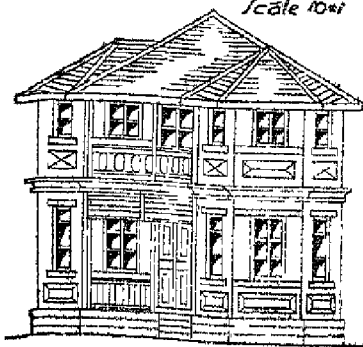


FIG. 15

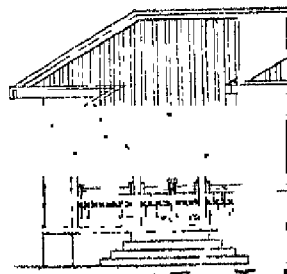


FIG. 16

page 38 about bay-windows which afford possibilities of imparting a charm to the of buildings, besides being useful in giving aspect. Figs. 15 and 16 show two such having bay windows.

Projecting doorways or entrance porches are

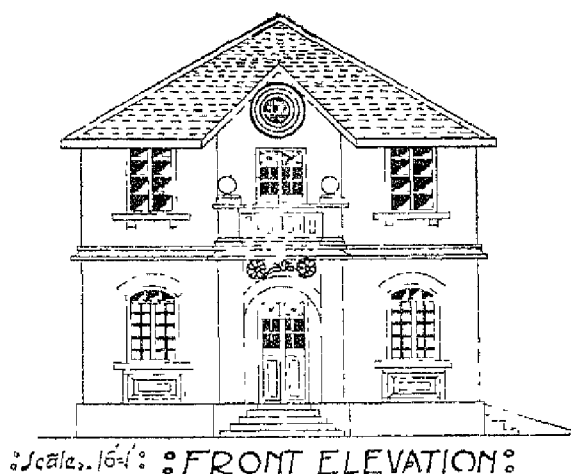


FIG. 17

another item full of opportunities of improving the appearance of the front. Fig. 17 shows the front elevation of a cottage with a projecting entrance porch, over which is constructed a terraced roof. An effect of beauty is still further obtained by the gablet in the central portion of the roof with a bull's eye in the triangular portion.

Chimney stacks, particularly when they are symmetrically grouped together, give a repose; but in India there are very few such cold places where fire places are required.

Roof is a very important feature in cottage decoration. A high pitch or steep slope no doubt gives a better appearance but in tropical countries like India where absence from snow does not justify it, it involves an unnecessary expenditure and is quite foreign to Indian architecture.

Fig. 18 shows an elevation of another in which a side-view of the entrance is shown. Mark the effect brought out by stucco plaster on the surface of brick supporting the water tank on the rear side.

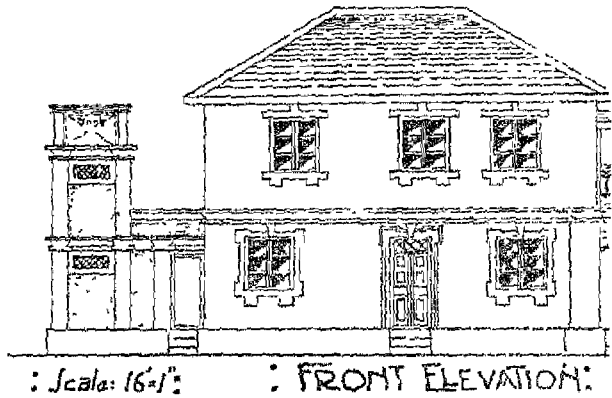


FIG. 18

Gablets, which are also often called

FRONT ELEVATION.

Scale 16=1.

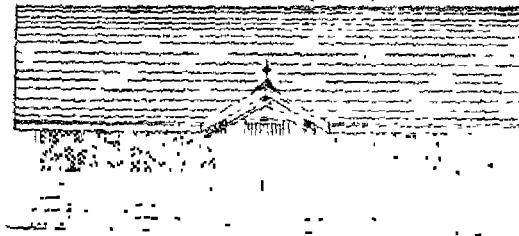


FIG. 19

money which they require is not only just but some times necessary. In fig. 19 the work in the front, has added to the effect city and composure of the elevation.

The parapet wall enclosing a flat or roof affords facilities of a variety of decorative different designs of panels, cornices, and rain water spouts.

Fig. 20 shows the effect produced by a small

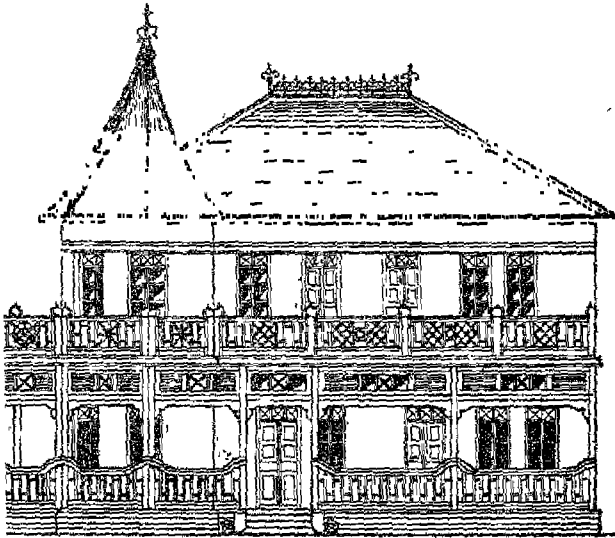


FIG. 20
: FRONT ELEVATION.:

FIG. 20

over a bay window. Mark the plain design of
ing in front of the verandah on the ground
floors which admits of easy cleaning.

air of calm composure and serenity given



LEVATION.~

• 16' 1" ~

G. 21

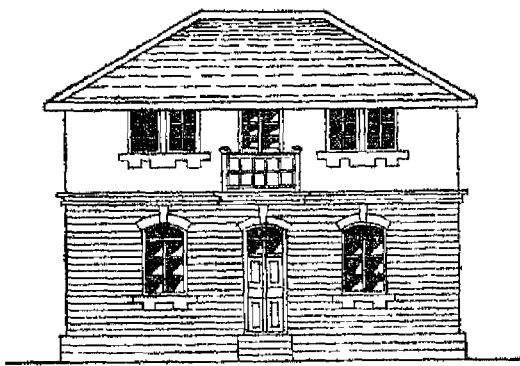
Scale. 16' 1"

FRONT ELEVATION.

FIG. 22

by symmetry is shown in figs. 21 and simple but beautiful shape given to the windows in fig. 21, adds to the beauty of The separate detached roofs over the bay in fig. No. 22 make the elevation look pict

This effect could be obtained even b



FRONT ELEVATION.
Scale 16'-1"

FIG. 23

in the centre. Fig. 24 shows still another mark how the central gablet in the roof rough cast plaster on either side in the panels make the elevation look gracefu

FRONT ELEVATION.
Scale 16'-1"

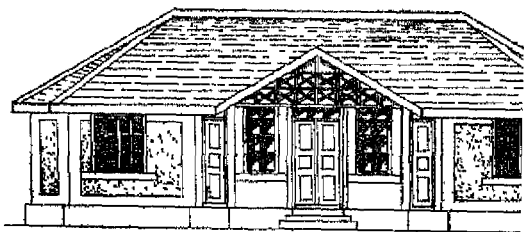


FIG. 24

en brick is the predominant material



FRONT ELEVATION:

FIG. 25

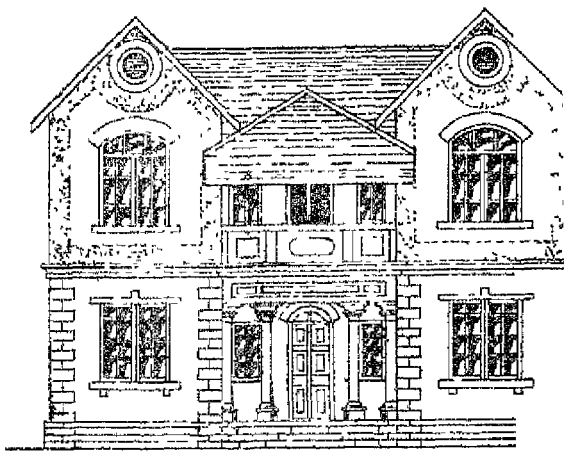
used it affords immense opportunities for simple, modest decoration, without costly ornamental plastered surface. The colour of the brick, as well as its bond, as seen in joints in the front surface, the width and finish of the

joints etc. give a variety of treatment. If special decorative effect is desired to be given by brick-work, it should be sparingly done for emphasizing special features such as entrance, pilasters, parapets, cornices etc. Arch in brick masonry costs very little, as compared with stone, and at once enhances decorative effect. Similarly octagonal or square pillars of brick or R. C. C., slightly tapering towards the top, conspicuously attract the eye (Fig. 25).

Another advantage of brick work is that it allows its outer surface to be plastered in a variety of ways to produce an effect of beauty, whether smooth cast, rough cast, plain coloured etc., or by the intermingling of these. A great effect can be given by the colour of the plastered surface. Colours mixed with cement generally do not fade away. If borders of doors and windows are

given a different treatment from the remaining surface, which might either be or rough cast another beautiful effect is In fig. 24 corners are left plain and the surface plastered rough. In fig. 26, in the of the upper floor, the reverse of this is corners are rough plastered and the interior surface left plain.

Fig. 26



FRONT ELEVATION.

FIG. 26

In stone masonry various methods of and the degree of smoothness to which it such as rough or rustic, draft-edged and tooled or bushed surface, chamfered and edges, medium, smooth dressed or polished on. The variation in thickness of courses—courses at bottom, gives another effect quoins smooth and leaving other surface gives still another effect. Using stones of different colour for corners and window-sills a pleasing appearance.

Sometimes a combination of stone and brick is made, stone is used for the ground floor and brick in the first and upper floors or stones are used only for corners and bricks for the intermediate masonry. (see the ground floor in fig. 26)

Instead of laying stones in regular lines of courses which often produces an effect of monotony, they are often laid at random. If they are selected of more or less uniform size and so laid, that the use of spalls or small stones is avoided, they present a very beautiful surface.

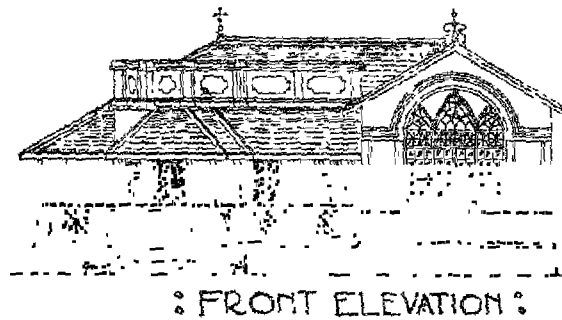


FIG. 27

In fig. 27 note the panelled surface of the parapet wall enclosing a terrace, also the architectural shape given to the front steps. The semi-circular arch in the gabled wall is further sub-divided into small pointed arches.

Furniture and Interior Decoration

The principal object of furnishing and decorating a house is to secure health and comfort. Whatever is pleasing to the eye is pleasing to the mind and beneficial to the body. Thus the beauty of form and colour which gladdens the mind is also conducive to comfort and health. The main factors affecting health are air, light and cleanliness. Hence, anything, howsoever elegant and beautiful, which interferes with any of these essentials is to be condemned.

It is a fortunate thing that wall papers, for which highly insanitary articles such as glue and paste, are required are rarely used in India.

The modern pieces of furniture such as, chairs, tables etc. were really speaking unknown to our ancestors. At best, the purely Indian furniture consisted of a chowrung (four-legged low wooden stool), a swing, with a planked board to sit upon, and bedstead ; carpets, with mattresses for squatting and cushions for reclining, being in use from time immemorial. Of late years as a result of the contact and communication with the Western people, the European dress slowly came to be adopted and with it chairs and tables which are necessary for it. They have now become a common feature in every home, whether adopting European or Indian style of dress, and thus a taste for furniture has been created ; in so far as this taste provides an additional industry to the

nation and to a certain extent contributes towards solving the problem of unemployment, it deserves to be encouraged. However, our national trait of a partiality for simplicity—plain living and high thinking—will always predominate above all. Hence, pieces chosen should be as few in number and as simple and plain in design as possible. They should not interfere with either light or ventilation, nor should they allow dust to lodge on their surface. For artistic effect, greater stress should be laid on elegance of form and charm of simplicity than on elaborate carving and architectural ornamentation. They should again, be capable of being easily moved aside on castors fixed to the bottom of their legs, so that the floor surface underneath them could be easily cleaned.

Plants in Rooms

In Western countries a decorative effect is obtained by cultivating plants in flower pots inside the rooms. This is a very good thing, and should by all means, be universally adopted in our country. Not only do they give an appearance of freshness and liveliness to the room, but also help to purify the air during the day time. Their action on air is, on the whole, the reverse of that of animals.

It is true, that plants respire like animals, breathing in oxygen and giving out carbonic acid gas. But, this process of respiration is very slow and is hardly perceptible during the night. On the other hand, the respiration during the day time is very insignificant with the reverse process of Assimilation, in which the green matter in the

leaves actually decomposes the useless carbonic acid gas under the influence of light and gives out a large amount of oxygen for the benefit of animals. On the whole, the presence of green plants inside the house is very beneficial. The air inside the house is charged with a certain amount of smoke which contains some elements such as sulphur compounds, particularly in the house where gas is used for cooking and lighting purposes. These are detrimental to the plant life. There are only a few plants such as a few varieties of cactus, some palms, and a few ferns which possess the power to resist these evil effects.

A small conservatory on the flat or terraced roof would, not only, add to the beauty of the house, but would be most enjoyable as a resort in the evening even for poor families who cannot afford luxurious conservatories in the cottage compound. It may here be suggested that excellent boxes of plants could be easily and cheaply constructed in the top layer of the parapet walls of terraced roofs. For this purpose the upper one foot layer of parapet walls should be lined on both sides with brick-on-edge masonry or 2 inches thick cement concrete walls on both sides with a few small holes for the aeration of plant roots; the central hollow should then be filled with earth and leaf-mould manure, in which a bed of roses or any other sort of plants may be cultivated.

Colours

Colours used in decoration have a powerful influence on the human mind. They act on the

nerves through the medium of senses. People in robust health may not feel their effects immediately, but the invalid and the sensitive are very susceptible to their influence. If they are in harmony, a sensation of pleasure is caused. If, however, they are discordant, an irritation of nerves, even amounting to headache, is the result. In spite of this, the majority of people are ignorant of the theory and effects of colours. The real artistic taste is found to be developed only in a few people. What commonly passes for artistic taste is more or less an imitation of what "men of taste" have done. It is therefore proposed to discuss here very briefly the elementary principles of colours.

What are called *Primary Colours*, are only three viz. *Yellow*, *Red* and *Blue*. All other colours are produced by compounding these in different proportions, but the former are not themselves capable of being produced by composition of other colours. Hence they are called primary.

Secondary colours are three viz, Orange (Red + Yellow), Green (Yellow + Blue), Purple or Violet (Blue + Red).

Tertiary colours, again, are three viz, Citrine (greenish yellow—green + orange) Russet (warm brown—orange + purple) and Olive (dull brownish green—purple + green).

Besides these, there is a variety of colours called *Neutral* colours. They are White, Black and Grey. White and black mixed in certain proportions produce grey.

White is the colour used for softening or reducing the purity of other colours in their original tints and making them look more vivid. Black is used as a shade or depth colour.

The distinction between a *tint*, *hue* and *shade* is worth remembering. By mixing white with an original colour, *Tint* of the same colour is produced; by mixing a colour with another colour, a compound colour or *Hue* is produced; and by mixing tints of colours with black, *Shades* are produced.

Colours on white back-ground look darker and those on black back-ground, appear lighter.

When two tones of the same colour are juxtaposed, the light colour looks still lighter and dark, darker.

The various colours should be so blended that the surface coloured should present a neutralised bloom.

Characteristics of colours :—

White is the most advancing of all colours i. e. it catches the eye first before other colours with which it may have been mixed or juxtaposed, by rendering their tints lighter and more vivid. White is expressive of purity and cleanliness and is sanitary looking. It absorbs heat least and radiates it most readily.

Black is the freakest variety and is the lowest in the series. It most contrasts with white. It can be skilfully used to give a soothing effect and break monotony or uniformity of other colours. It is an opposite extreme of white in respect of absorption and radiation of heat

Yellow, next to white, is the most advancing colour, it is indicative of delicacy and gaudiness and is often called a sunlight colour, it stimulates the nerves, often causing irritation, if it is deep in tint. The contrasting colour of yellow is purple inclining to blue.

Red is the most stimulating of all colours, so much so, that it irritates the nerves, tires the eye and causes an after-feeling of depression, the result of over-stimulation. It is very agreeable and charming when in juxtaposition with green. It partakes of warmth. It appears to deepen in shade or vanishing light.

Blue is the most retiring colour. Next to dark it contrasts best with white. It is a cool colour and is very powerful in strong light. It gives a soothing effect and is suitable in bed rooms. It causes a discord when it comes in juxtaposition with green. To correct its coldness it should be contrasted with white or orange. Blue is very agreeable to the eye in all harmonious combinations whether in juxtaposition or mixtures.

Orange, like yellow, is very advancing and is also called a sunlight colour; it is healthy, stimulating and a cold colour. It causes a discord with red or yellow and forms an agreeable combination with blue. It is more effective at a distance.

Green is the most soothing, cool and restful colour. It least excites the retina and hence is very much appreciated by the nervous system. Its discording colour is blue. Green is the Nature's most favourite colour and particularly when it

contrasts with red in Nature it looks very charming and delightful. Its coolness can be cured, if necessary, by mixing some yellow in it.

Purple is, next to green, agreeable to the eye; it is cool and refreshing. It is regarded as the imperial or majestic colour. Its contrasting colour is yellow.

Grey is a neutral colour; it causes a soothing, restful impression on the mind. It is particularly good in sunny rooms, where the sunshine corrects its coldness.

Brown is a warm colour, it is indicative of strength, stability, vigour and comfort. It forms an excellent back-ground for pictures. Hence it is very often used in bed rooms. It is the proper colour for prayer or worship rooms as it helps in giving them an air of gravity and solemnity.

Cream is one of the very soothing colours and is generally preferred for parlours, office-rooms etc.

Cool colours should be used in sunny rooms and *Warm* ones in the sunless ones.

Parlours should be treated with blue, grey cream; bed-rooms with green, brown, pink, orange, blue or purple; verandahs, with cream, blue or green; office room, with cream or grey; kitchen and dining rooms with yellow. Bath and toilet rooms, white. The walls of the room in which pictures and beautiful scenes are to be hung should be coloured with a simple quiet, light colour to serve as a back-ground for pictures.

Grey or white borders in corners and round door and window openings give an effect of smallness to the room. If the colour of the skirting matches with that of the floor or floor carpets, it gives an effect of width to the room.

There is always a personal factor or individual taste in respect of colours. What one person wants to shun, may be most appreciated by another. There are even some people who are colour blind. All that can be done, therefore, is, to acquaint the reader with certain principles commonly accepted and this has been attempted above.

Mitigation of Heat

The question of mitigating heat is as much important in tropical countries like India, as that of warming and heating is, in the Western countries for the attainment of comfort. It would, therefore, be not inappropriate here to make a few remarks about it.

All heat is derived from the sun and is felt as a result of either conduction, radiation or convection. We are not much concerned with the first, because the sun's rays while passing through the layers of air in the atmosphere do not materially heat them, air being a very bad conductor of heat. We are mainly concerned with radiation. Convection, as far as it affects us, is a result of radiation. Land is a better conductor of heat than water, hence it absorbs more heat of the sun by day and is heated more than water in the sea. In consequence of this the temperature of the air, in contact with land, rises more than that of the air in contact with water, which makes it lighter and rise to top, its place being taken by colder air from the sea (sea-breeze).

It is thus the radiation of the sun's heat absorbed by the materials, of which a house is constructed which affects the temperature of air in the house. The only remedy to minimise the effects of this heat is the use of highly non-conducting materials. By far the best material in this respect is air, which is the worst conductor of heat. We can use air for protection from sides in two ways. (1) by pro-

vision of deep verandahs, which has been already discussed on a previous occasion in detail (see pages 33 and 51), and need not be reiterated here, and (2) by constructing hollow walls, which is a very effective remedy. But hollow bricks are not much in use in India; besides, unless scrupulous care is taken during construction, mortar is likely to fill in the hollow space which is very narrow and thus defeat the very object. This is, again, objectionable from a sanitary point of view, because, if anything decays or putrefies in the hollow space it is difficult to remove it.

Enclosing an air space below the roof is a very effectual remedy. Wood is a very bad conductor of heat; hence, if plank ceiling is constructed and $1\frac{1}{2}" \times 1"$ battens spaced $2\frac{1}{2}$ ft. apart fixed vertically and $1" \times 1"$ battens are horizontally nailed on their top for receiving Mangalore tiles, an air space of $2\frac{1}{2}"$ deep is left which makes the rooms cool and comfortable. In addition to this the materials used in the exposed surface of walls and roof should be bad conductors of heat.

Stone absorbs more heat than brick. Hence, brick houses are cooler than those of stone. Mortar i. e. plaster is a worse conductor than either brick or stone. Earth or clay is a still worse conductor. Therefore walls of unburnt bricks or of *pise de terre* make the house more comfortable. That is why flat mud-roofs are cooler than concrete terraced roofs, which, again, are cooler than tiled ones.

Out of metals used in building construction, copper is a very good conductor, brass stands 2nd, steel and iron 3rd, and lead, last of all.

The colour of the surface exposed to sun's radiant heat has a great effect on heat. White absorbs least heat, which it radiates again most readily. Its opposite extreme is black which absorbs it most and radiates, least. The intermediate between these in their order of less absorption and more radiation are yellow, green, blue and red. White-washing the outside surface of walls is a very effectual remedy. Slates used for roof-covering which are of stone, and hence absorb considerable heat, could be rendered cooler by colouring them with a white wash.

Under-ground cellars, as they are not exposed to sun, remain cool. However, it is not possible to provide a thorough ventilation in them unless artificial means are employed. They are, again, likely to be affected by damp.

Perspiration is a usual concomittant of discomfort due to heat. Air in motion tends to lessen it and hence the importance of thorough ventilation. This has been already touched upon on pages 32 and 47.

Analysis of cost.

The factors which affect the cost of buildings are:—

- (1) Cost of labour
- (2) Cost of materials
- (3) Proportion of cost of labour and of materials to the total cost
- (4) Proportional cost of each item of work to the total cost.

(1) *Cost of labour*:—The average result of the analysis of costs of nine buildings of various types, built both in towns and rural district, goes to prove that the cost on account of labour is 34·6, (say roughly 35) per cent of the total cost, and that on account of materials is 65 per cent.

How this 35 % money is distributed will be seen from the following table:—

Trade	percent.
Excavator and Concretor	4
Mason (Laying stone or brick masonry plastering, paving, pointing etc.) ...	35·5
Carpenter and joiner	21·5
Smith	2·0
Fitter	2·6
Ghaniwalla (mortar grinder)	6·3
Electrician	2·8
Painter	3·6
Plumber	4·0
Tiler	1·5
Supervisor	15·0
Miscellaneous (Fencing, clearing site, glazier etc.)	1·2
	100·0

The cost of labour is dependent on (a) rates of wages (b) efficiency of labour and (c) period of working hours.

(a) If the rates of wages of different trades prior to 1914, (i. e. before the Great War broke out), are compared with those current at present (1930), it will be seen that the average rise is 100 per cent. They reached the highest level in 1914 and have, since then, remained practically stationary. The table given below indicates the rise in the rates of wages of different trades in detail:—

Trade	Rate of wages					
	1914			1930		
	Rs.	as.	ps.	Rs.	as.	ps.
Male Coolie ...	0	4	0	0	10	0
Female Coolie ...	0	2	6	0	6	0
Mason ...	1	0	0	1	12	0
Carpenter ...	1	0	0	1	12	0
Bhistie ...	0	12	0	1	4	0
Black-smith ...	0	12	0	1	12	0
Painter ...	0	12	0	1	4	0
Bullock Cart ...	1	0	0	2	0	0

Note:—The rates quoted above are those prevalent in the Poona District and are of the average class. Thus, for instance, the wages of a first class mason are Rs. 2 per day and those of a 2nd class mason are Rs. 1-8; therefore the average of the two, viz, Rs. 1-12 is taken.

In rural districts unskilled labour is cheaper than in urban area. For instance, a male coolie can be had at annas nine per day beyond 10 miles of Poona and at annas eight per day beyond 20 miles.

But skilled labour, or artisans who have to be imported from town for work in villages at extra rates, are costly. The local artisans are generally inefficient and give work which is less in quantity and inferior in quality; hence, they prove to be very costly in the long run. And, as the proportion of the cost of the skilled and unskilled labour, severally to the total cost on account of labour in a building work of an ordinary character is almost equal, viz, 51 p. c. and 49 p. c., the total cost of labour is ultimately the same both in rural as well as in urban areas.

(b) Efficiency of labour is a great factor in reducing the cost of a building. The Indian labourers, in general, lack a sense of duty. Their general tendency is to scamp work. It is, therefore, upon the maistry who directly supervises the work that the success, in economy, depends. He is not only responsible for good or bad work, but also for the diligence or slothfulness of the labourers under him. Instead of trying to keep all labourers all the while busy under his eye, he should allot a certain task work to each trade, so that, the quantity of work would be guaranteed. As regards the quality he should test it from time to time. The maistry must, therefore, know not only what good work means, but also what quantity or task one must finish for the rate one draws.

(c) Of course, the quantity of work is proportionate to the number of working hours. There is no fixed limit for working hours in India except under the Factory Act. Hence work is done from sunrise to sunset. Thus varying seasons allow a varying number of hours. In summer they are 20

to 25 per cent more than those in winter. If, instead of insisting upon a fixed period, it is bet upon the task work executed.

(2) *Cost of materials*:—The following shows a comparison of prices of building materials between the pre-war (1914) and the post-war (1930).

Material	Unit	Price		
		1914		
		Rs.	a.	p.
Rubble (trap)	100 C. ft.	6	0	0
Burnt brick (table-moulded)	1000 Nos	12	0	0
Slaked lime	100 C. ft.	30	0	0
Trap metal 1½"	100 C. ft.	5	8	0
Timber (country out teak)	C. ft.	2	8	0
Do Moulmein	"	4	0	0
Sand (river)	100 C. ft.	4	0	0
Mangalore tiles	1000 Nos	70	0	0
Do ridge do	100	30	0	0
Cement	ton	62	8	0
Charcoal	Maund	1	12	0
C. I. sheets	Cwt.	11	8	0
Zinc paint	"	30	0	0
Mild steel	"	7	8	0
Linseed oil	gallon	2	8	0
Distemper	Cwt.	27	0	0
Glass panes	each	0	4	0
Surati lime	40 lbs.	1	0	0
Coal tar	cask	20	0	0

The average rise in the prices of materials may be taken to be 70 p. c. Cement and bricks to the extent iron and C. I. sheets are the only materials which have become cheaper than the pre-war prices.

The combined effect of the rise in wages and of prices of materials is to increase the cost of building by about 25 per cent.

al rise of 86 per cent in the total cost of a building over the pre-war price.

(3) The subjoined table shows the different proportions which the cost of unskilled labour, skilled labour and materials, bear to the total cost of each item of work:—

Item.	Cost of Material	Cost of Skilled labour.	Cost of unskilled labour.
Excavation	* 10	...	90
Concrete	70	...	30
Uncoursed rubble masonry	70	20	10
Coursed rubble 2nd sort do.	56	25	19
do. do. 3rd do.	56	20	24
Brick-work	66	17	17
Lime pointing to stone masonry	18	57	25
do. Brick-work	20	60	20
Rough cast plaster	56	28	16
Cement plaster	64	25	11
Concrete jack arches	73	3	24
Brick-work do.	78	14	8
Plank ceiling	79	8	13
Manglore tiled roofing	81	11	8
C. I. Sheet roofing	76	10	14
Country tile roofing	71	11	18
Terraced roof	80	13	7
Doors panelled	69	23	8
do. $\frac{1}{2}$ glazed $\frac{1}{2}$ panelled	69	23	8
do. plane planked	76	18	6
Windows glazed	69	22	9
do. Plane planked	82	13	5
do. Iron barred	84	7	9
Distempering	57	19	24
White-washing	31	38	31
Wire fencing	79	17	4
Teak wood trellis work	45	45	10

* Some times foundation trenches have to be excavated deep in soil, earth, or soft shedu and the sides have to be protected by shoring. The proportionate cost on account of this has been taken into account here.

(4) Proportionate cost of each item to that of the total work.

This is very important, because it gives a clue to the various directions in which economies of money could be effected. The following table, in which the average result worked out from observations of details of expenditure of 7 buildings, 6 of which were cottages and one a flat, are given. Although it is not quite exhaustive, it is, nevertheless, capable of throwing a flood of light on where the money goes:—

Trade	per cent cost
Excavator and Concretor	4.5
Mason (Wall of brick, stones etc.)	34.4
Carpenter and joiner	22.0
Fitter and iron-monger	3.3
Plasterer	7.1
Pavier	5.0
Floorer (flooring supported on Walls)	13.2
Tiler	4.8
Painter	3.2
Plumber	2.5
	100.0

The table given below shows the percentage of cost which each item of estimate bears to the total cost of the building:—

Item	percentage of cost
Excavation for foundations and filling in concrete	4.5
Masonry up to plinth	9.2
Masonry of super-structure	23.3
Doors	10.2
Windows and cupboards	8.5
R. C. C. lintels over doors and windows	2.3
Flooring (Supported on Walls)	13.2
Paving	5.0
Wood-work (post, post-plate, shelves, lofts, trellis, trusses etc.)	9.0
Stairs	2.7
Roofing	5.3
Water closet	2.8
Drainage and gutters	1.8
Fencing and miscellaneous	2.2
Total.....	100.0

***Some facts about building costs**

(1) The average cost on account of labour in a building amounts to 35 per cent and that on account of materials 65 per cent.

(2) $\frac{2}{3}$ amount is required for the skeleton and $\frac{1}{3}$ for finishing such as tiling, plastering, painting etc.

(3) On an average the cost up to plinth level is Re. 1 to $1\frac{1}{4}$ per square foot.

* For a detailed explanation of these facts borne out by figures of calculation the reader is requested to refer to the author's "Sulabh-Vastu-Shastra." (to be had from the author. Price Rs 3 per copy, postage extra.)

(4) Mud mortar of good earth is no less durable than lime mortar provided sufficient safeguards are taken in respect of drainage, viz, (a) protecting exposed wall surface with lime or cement pointing or rough cast plaster, (b) constructing a perfectly water-tight roof and (c) building walls from foundations up to plinth in lime-mortar.

(5) When the rate of sound burnt bricks, $9" \times 4\frac{1}{4}" \times 2\frac{3}{4}"$ per 1000 (number) is less than $2\frac{1}{2}$ times the rate of sound rubble per 100 cft. brick masonry is cheaper than stone masonry. Moreover, brick possesses innumerable other advantages over stone.

(6) A timber framed structure with stone or brick in mud walls costs more than a *pucca* structure of stone or brick in mortar, unless the outer walls also of the framed structure are reduced in thickness of half or one brick i. e. $4\frac{1}{2}"$ or 9". The latter however, is objectionable from the point of view of heat and raids of thieves.

Business Aspect of House Property.

The rental value of a building is determined by the following factors.

- 1 The interest on capital outlay
- 2 Working expenses
- 3 Profit

Under capital outlay come the following:

- (a) Cost of site including legal expenses
- (b) Cost of development, such as, levelling, drainage, water-supply, roads, fencing, garden.
- (c) Cost of building including that of out-houses such as stables, garage, servant's quarters, lumber room etc.

Out of these, (a) cost of site depends upon locality, nature of soil and foundation, water supply, position etc. and is a greatly varying factor. As regards (b) the cost of a 20 ft. wide metalled road with cross drainage works such as culverts, pipe-drains etc. of ordinary type may be taken at Rs. 3 per foot length and that of drainage of 4 inches stone-ware pipes suitable for a single house with traps, inspection chambers etc. at annas twelve per foot. Pipes, less than 4" diameter, are not allowed for house drainage (c) The cost of building depends upon a number of factors, its size—the incidence of cost of small buildings is more than that of large houses, a two storied building costs less than either a single storied or more than 3 storied one, it also

depends upon the specifications and materials used. Fastidious insistence of absolutely flawless materials is bound to increase the cost. Bay windows, turrets, angles and projections etc. are sure to increase the cost and so on.

Under (2) working expenses come the following:—

- (a) Repairs and renewal charges
- (b) Supervision, collection of rents and management
- (c) Rates and taxes
- (d) Lighting, water, insurance.

The interest charges and the rents being more or less fixed quantities, maximum profits occur if the working expenses are reduced to a minimum.

The following facts should be remembered in connection with reducing the repairs charges.

(a) A substantially built dwelling requires less repairs.

(b) A chawl or tenement house requires more repairs than a flat, which, again, costs more for repairs than a cottage type dwelling. This is mostly due to two reasons (1) The people living in flats and cottages belong to a higher grade of society than those in chawls and have got a better sense of keeping things in a state of repairs and (2) chawls and to a certain extent flats are used in common by different people and therefore the responsibility of keeping the building in a state of repairs is commonly shared, whereas it has to be shouldered by one family living in a cottage.

(3) The financial position of the landlord is an indirect though a sure factor affecting the cost of repairs. If it is sound, he can adopt a "stitch in time policy" which really saves him "Nine". If the repairs are delayed or neglected, Nature requires him to pay penal charges ten times those of the prompt repairs.

(4) The treatment meted out to the tenants also indirectly affects the repairs bill. If it is full of courtesy and kindness and if the owner is ever willing to respond to the request to remove the little *reasonable* inconveniences of the tenants particularly in respect of repairs, they, on their part too, take better care of the property with a resulting reduction in the repairs bill.

(5) It is prudent to fix a slightly less rent in the first instance and to secure the good will and with it the permanency of tenants than charging unreasonably high rents and giving a cause to them to make frequent shifts which results in loss of rent due to bad debt and empties. Besides the property also suffers damage by its careless use by too many irresponsible people.

(6) If the house is well planned and well built the losses on account of empties are very little.

(7) There are less chances of losses resulting from quarters remaining untenanted if they are built in small cottages suitable for middle classes or still better, flats suitable for poor classes than building one big house suitable for one rich family.

Repairs and renewal charges amount from $\frac{1}{4}$ p. c. to $\frac{3}{4}$ p. c. of the capital cost per year or 5 to 15 p. c. of the gross rental.

(b) Supervision and collection charges vary from 0 to 4 p. c. of the gross rental, depending upon the extent of the property and the class of people inhabiting it. If the property is small it could be very easily managed by the landlord himself; if large, permanent establishment has to be maintained.

(c) Rates and taxes vary from 5 to 18 p. c. of the rental

(d) The charges on account of lighting, water-supply and insurance vary very much.

(3) *Profits*:—If the property belongs to one individual person or a family, whatever balance remains out of the rental collected after setting aside the requisite amounts to cover the working expenses and interest on capital cost, is appropriated as the profit. If the property belongs to a company, a part of it varying from 1 to 2 per cent of the capital cost or 5 to 10 p. c. of gross rent is credited to sinking fund, another suitable part is set apart as reserve fund and the balance is distributed as a dividend on the amount of the share capital. If the property belongs to a public body, the whole amount of net profit is carried to reserve fund.

The total working expenses on account of all the above causes amount to from 20 to 40 p. c. of the gross rental. On an average 3 to 4 months gross rent should suffice to meet all the repair charges.

Introduction to Plans

The plans in the following pages have been divided into 5 classes:—(1) Bungalows; (2) Storeyed Cottages; (3) Terrace Houses; (4) Flats (5) Mansions and Palaces.

The word “bungalow” has been used in this book in a sense rather different from what is commonly understood in India. It is popularly interpreted to mean any commodious, pretentious cottage whether storeyed or not. But in this book it has been used to mean a single storeyed house or a ground floor structure without an upper storey. ‘Terrace’ houses are houses with a narrow frontage, built, attached to each other by a common wall, in rows lining a street. They derive their light and air in two directions only viz, the front and the rear. They are far superior to chawls or tenement houses which equally lack facilities for ventilation, and in addition, do not give any privacy outside the room door. The terrace houses, if their party walls be sound-proof are quite independent separate units with a small open yard either in the front, or rear or both, also separated by party walls from the adjoining units. The chawls deserve to be condemned and discouraged as far as possible, hence, I have not considered them at all in the present volume.

Mention has been already made in the main introduction about the costs of buildings given in the book. They are likely to vary according to the fluctuations of costs of labour and material. However, they will be useful to give some rough idea, at

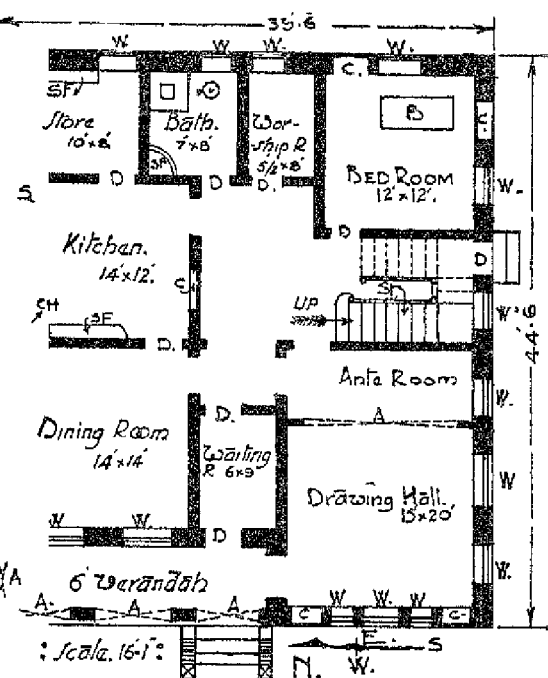
least for comparison of one plan with another. The rates of labour and material on which they are based are given in the statements on pages 100 & 102.

In most of the plans in addition to the plinth area, figures of carpet or living areas are also given. In calculating them the area occupied by walls, lobbies, verandahs less than 5ft. in width, bath room and W. C. are deducted from the plinth area. This living area bears a certain proportion to the plinth area, and the higher this proportion is the more compact and economic is the design. It varies from 55 per cent to 80 per cent; but in cottages which are supposed to be an economical type of buildings it should never be less than 65% in bungalows and 62% in storied cottages.

A word in explanation of the sanitary arrangements shown in a number of plans is necessary here. The question of fixing the position of a W. C. in a house, so that instead of being a source of nuisance, it should add to the convenience, always presents some difficulties. Hence, they have been specially given for guidance of people living in towns where water carriage system is adopted. In rural districts and towns where there is no water carriage system, any other use of the space such as a godown store, bath room etc could be made or in some cases where feasible their area should be incorporated in that of the living rooms, and privies built in a detached position. Similarly, as construction of a pitched roof in a proper manner is not always easy, roof-lines are shown on most of the plans. In Northern and Central India, where flat roofs are constructed they may be omitted.

A Key to the Reading of Plans.

the guidance of some laymen who have seen plans, a typical plan is given below in which, it is hoped will make all subsequent plans intelligible.



° GROUND FLOOR PLAN °

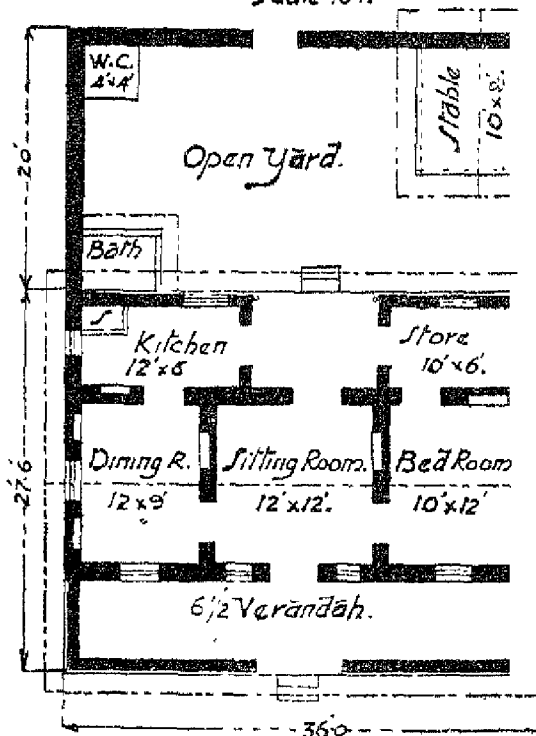
Diagonal dotted cross lines), indicate arches; W, W, (along walls near the outer edge), windows; C, C, (Recess boards; D, D, (Breaks in walls), doors; St, staircase; S, sink; SF, Shelf; B (Rectangular fig. in bed room), bed, N, (The arrow on the right, in the front). Shows the front. The present plan faces West.

BUNGALOWS.

Plinth Area 990] PLAN NO. 1 [Cost

This type of cottage is suitable in rural

GROUND FLOOR Scale 1/8" = 1'



FRONT ELEVATION Scale 1/8" = 1'



where a self-contained little villa encl small compound wall is required. It sho

ably face North or North-east. Both the front and rear verandahs are closed by 3ft. dwarf walls of brick nogging and wooden trellis work above. The light in the central sitting room is likely to be slightly obscured, still it is the coolest room in the whole cottage. The old village houses were built on the same system as this one with a central sitting room and closed verandahs all round. Ordinarily the verandah on the rear side is sufficient for the purposes of a dining room for a small family. In that event the dining room could be used as a bed room. When a few friends are invited to dinner the dining room or the central sitting room could be utilised for the purpose. A small removeable curtain across the front verandah on one side of the entrance would make a small room for boys of school going age to do their home lessons. The bath room is detached in a corner adjoining kitchen in the rear yard. It is further screened by the compound wall. A small cow-shed or stable for a pony in the rear yard with an exit gate in the compound wall make the arrangements complete. A loft below the roof of the stable provides room for storing fodder for the animal. In the opposite corner the position of a privy is shown. A small cheap shed over the area between the stable and the store room would be very useful for storing fuel. The plinth area of the cottage is 990 sq. ft and the living area 784 which bears a proportion of 79 per cent to the former. Thus the plan is one of the most economic ones. The building, with stone in mud walls lime pointed on the outside and a roof of round country tiles is actually built and has cost 3450 Rs. including the compound wall.

Plinth Area 1050] PLAN NO. 2 [Cost Rs. 4100

This is a plan of a small cosy cottage providing

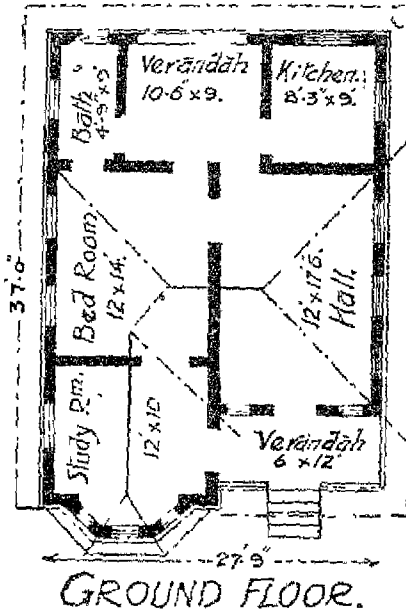
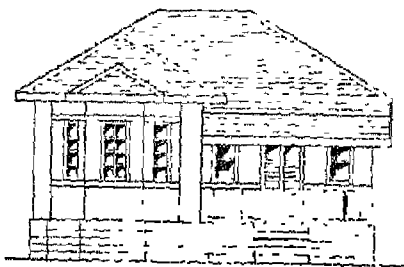


FIG. 31



FRONT ELEVATION.

Scale. 16-1.

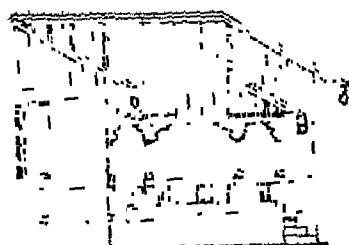
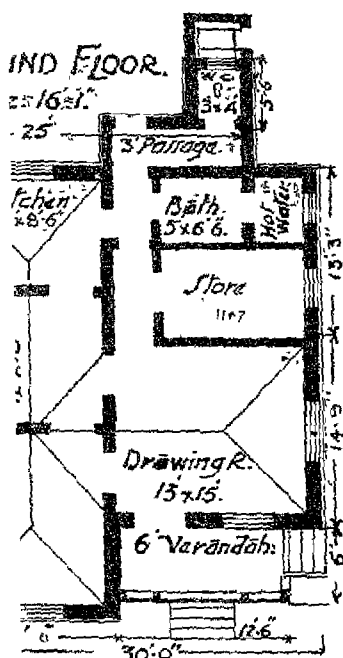
FIG. 32

all the necessary accommodation commonly required by a small Indian family. The size of the parlour is really excellent. The front verandah will serve as a waiting room and the one on the rear side as a dining room. The two bed rooms one of which is called study room in the plan are spacious enough. The bay window in the front considerably adds to the beauty of elevation. The roof is quite simple involving only one valley. The plan is suitable for a South or a South-east facing. All the outer walls are $1\frac{1}{2}$ brick thick and inner ones one brick thick. The plinth area is 1050 sq. ft. and the

living area 745 which bears a proportion of 71 per cent to the former. The cost is about 4100 Rs. with a pucca structure of Brick in lime masonry.

rea 1024] PLAN NO. 3 [Cost Rs. 4500

s is a plan of a small cottage convenient



FRONT ELEVATION

Scale 16=1

FIG. 33 & 34

in every respect.

The left hand portion is projected a little beyond the verandah on the right hand side just for the sake of an artistic elevation.

Similarly the verandah is made 4 ft. shorter for the sake of obtaining a beautiful effect in the elevation of the roof. The sizes of

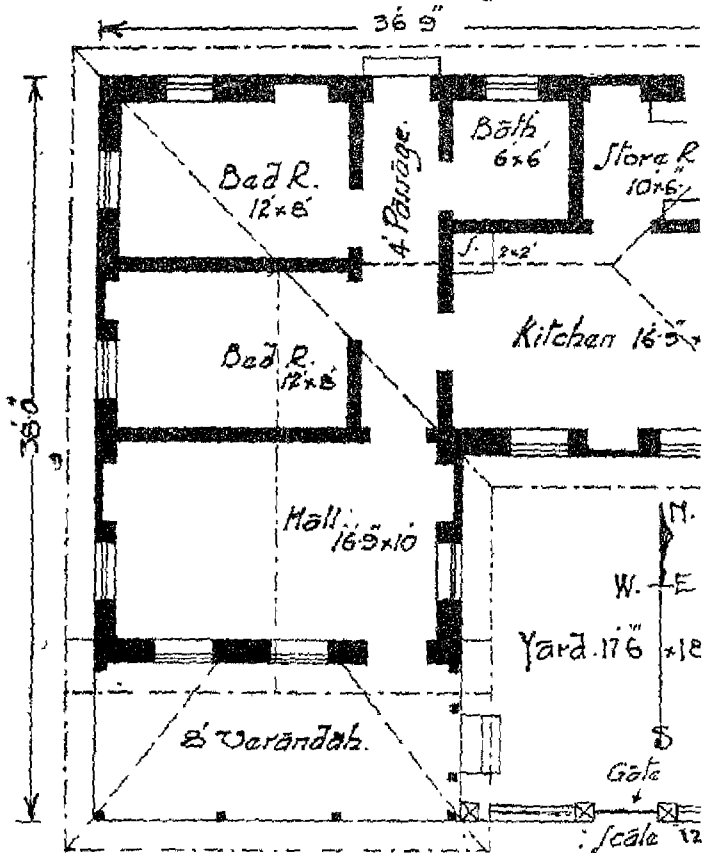
all the rooms are not bad for a typical small cottage like this. All outside walls are $1\frac{1}{2}$ brick thick and inner partitions either 9" or $4\frac{1}{2}$ " thick.

The w.c. is of a cess pit type i.e. the solid and liquid

carried by water and allowed to deposit in chamber having an air-tight cover from is daily carted away. The w.c. is separated main building by a 3 ft passage as required Municipal Byelaws, Bombay. The roof is ample with only one valley gutter.

Plinth Area 1110] PLAN NO. 4 [Cos

This is a convenient design of a small



: GROUND FLOOR PLAN. :

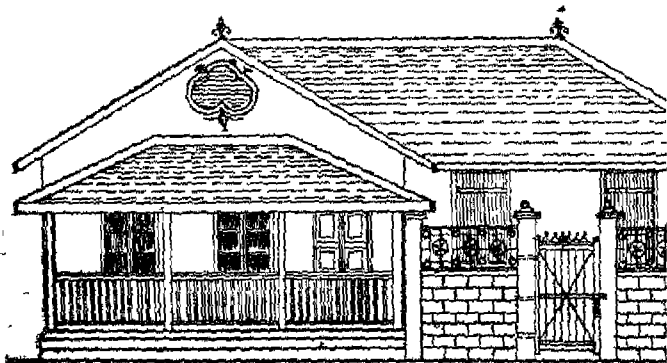


FIG. 35 & 36

The main entrance is through a compound enclosing an open yard. There is a half closed verandah in the front, behind which there is a hall and living room. The kitchen is a commodious one obviating the necessity of a separate dining room. There is a small store room attached to the kitchen. There are two bed rooms, though rather small, but their privacy is maintained by the immediate 4 ft. passage. There is a back entrance leading to a privy which is supposed to be built at a distance. The direction in which the cottage is to face is shown by the North line. The small verandah enclosed by a compound wall is a speciality design. The plinth area is 1110 sq. ft. and the cost is Rs. 4250. The living area is 698 sq. ft. which bears a proportion of 63 p. c. to the plinth area.

Area 1200] PLAN No. 5 [Cost Rs. 3850

This is a plan of a building actually built. All

FRONT ELEVATION.



Scale 1/4" = 1'

FIG. 37

all including the intermediate ones are of

stone in mud, the exposed surface only cement-pointed. There is a spacious verandah at the front. The room on the right hand side of the hall is better used as a bed room and the other as a parlour. The front verandah, if made wider by a foot would serve as a very good place for sleeping in the hot weather season. The

GROUND FLOOR.

Scale. 12"=1'.

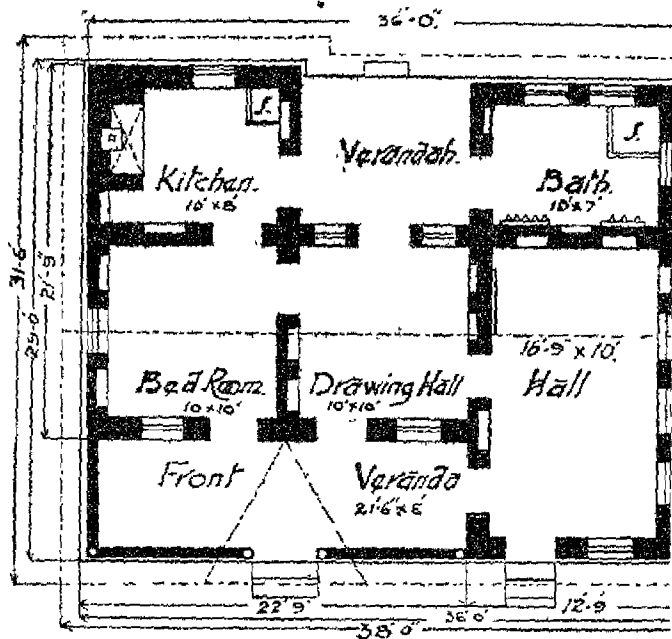


FIG. 38

smoke outlet provided in the kitchen. The front verandah will serve for a dining room. The drawing hall is sufficiently spacious. The roof is very simple and involving no necessity of expensive trusses. The plinth area is approximately 1200 sq. ft. The floor area is 728 and bears a proportion of 71 p. The cost is 3850 Rs.

ea 1190] PLAN NO. 6 [Cost Rs. 5350

is a plan typical of the buildings erected in the suburbs of Bombay, built by the Development Department. There are too many angles and projections not only on the outside front but also

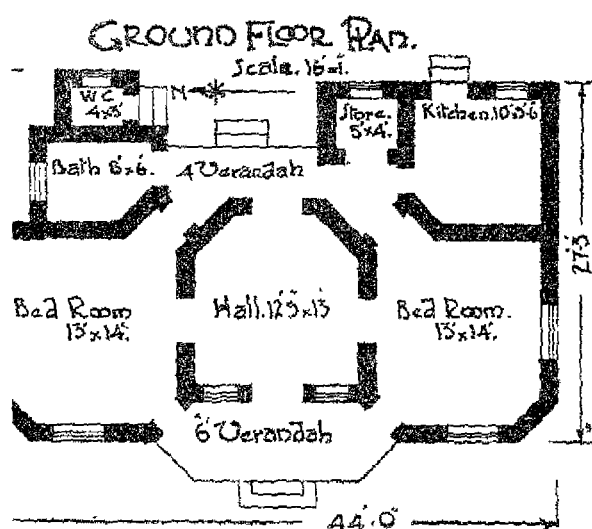


FIG. 39

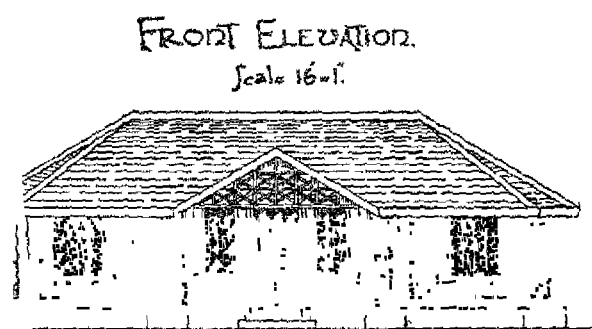


FIG. 40

hence it is bound to cost more. The 6 ft. verandah in the front will serve as a very good sitting place but as already mentioned in the

chapter grouping the central position of the drawing hall is sure to cause an inconvenience to an Indian family. There are two bed rooms of a very good size. The rear verandah is too small to serve as a dining place, for which there is no other room than the bed room near the kitchen. The kitchen, again is too small. The services are accessible independently from any bed room. This is one of the plans in which artistic beauty is sought to be obtained at a certain sacrifice of living space. The plinth area is about 1190 sq. ft. The living area is about 770 bearing a proportion of a little less than 65 p. c. to the plinth area. The cost is Rs. 5300.

Plinth Area 1337] PLAN NO. 7 [Cost Rs. 5270

This is another plan of a building suited to rural districts. There is a verandah 7'-6" wide in the front in which a light partition is erected to make a small office room. If the rear verandah is used as a place for dining there would be three bed rooms in addition to a kitchen and a drawing room. The small store room is situated at a convenient place with respect to the kitchen, in which a number of additional wall cupboards are provided. There is an open yard on the rear side which is enclosed by a compound wall. A latrine in one of the distant corners and a cowshed with a loft for storing fodder on its top and a small space for storing firewood would make the arrangements complete. The room in the front, on the right hand side having a separate front entrance

very suitable to accommodate a guest. This actually built in rural area and has cost

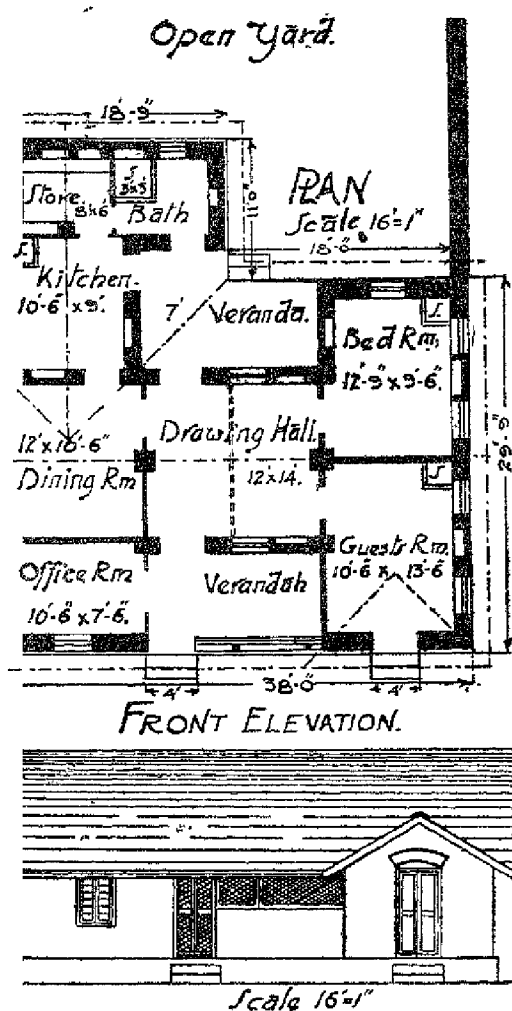


FIG. 41 and 42

including the compound wall. Its plinth 337 sq. ft. The living area is 1010 sq. ft. rtion to P. A. is 75 p. c.

Plinth Area 1320] PLAN NO. 8 [Cost Rs. 5730

This is a cosy little cottage built in a plot of

FRONT ELEVATION.

Scale 16'-1".

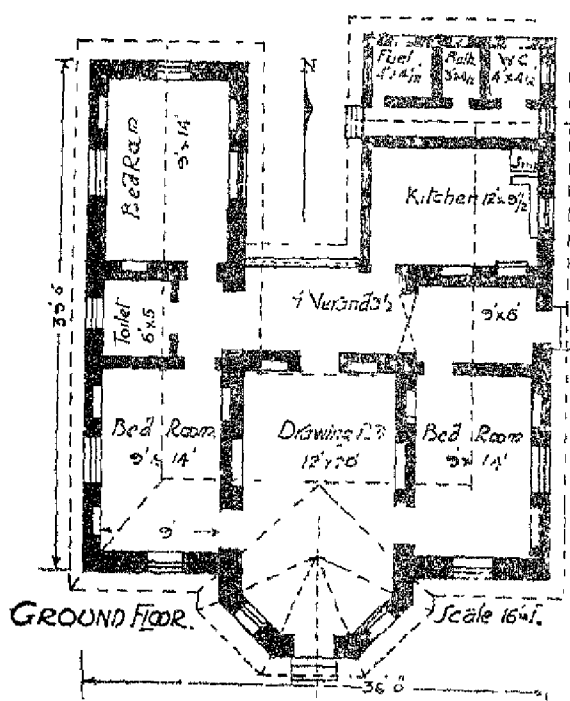
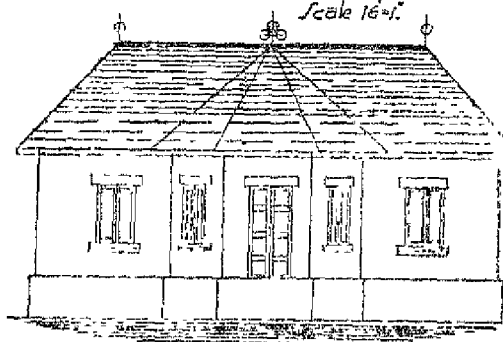


FIG. 43

FIG. 44

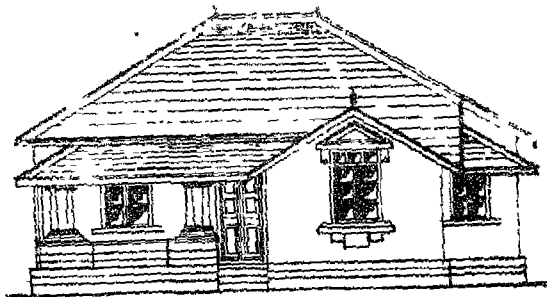
dressing room between the bed rooms on the

ground facing South in the Saraswat Colony Poona. It has been found by experience to be a very convenient and comfortable cottage. The bed rooms on the West get an ample breeze. All the rooms are elongated instead of being square. This has been found to be a great advantage; 9' x 14' is a far better room from the point of utility than one of 11' x 12', though the latter has a bit more superficial area. There is a small toilet or

West side. The room on the right hand side of the Drawing Room is a convenient one for a guest. The rear verandah serves the purpose of a dining room. When it is intended to add another floor the small vestibule $9' \times 6'$ in the centre on the right hand side is the proper place for locating a dog-legged (having two flights parallel to one another) staircase. The only disadvantage found in this design is that the open court-yard on the rear side is rather very much restricted in width, with the result that breeze does not play freely in that part. In consequence of this the walls heated by the sun do not quickly cool down. The cost of the building is Rs.5780.

Plinth Area 1300] PLAN NO. 9 [Cost Rs. 5050

This is one of the very convenient cottages. It is suitable for a North facing. In the front there is a verandah to serve as a waiting room or sitting out place. The kitchen, dining room and store room are very conveniently situated with respect to each other. The bed rooms are placed on the West side. The position of the bath room is excellent. There is a back exit which is so very

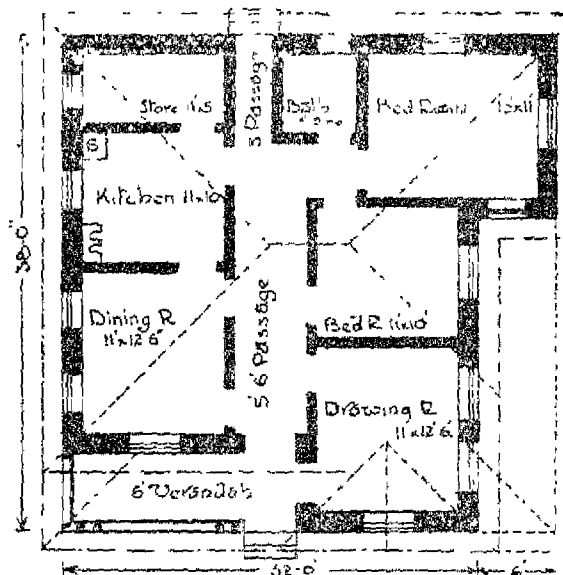


∴ FRONT ELEVATION ∴

FIG. 45

necessary in Indian homes. The dotted lines on the

right hand side show the position of a verandah which, if constructed, will co add to the comfort. Instead of a regular if a wooden trellis work is construc vine creeper trained on it, it would same comfort at a very cheap cost. T passage, no doubt preserves the privacy rooms, but if it were even 4 ft. wide have equally well served the purpose an



°GROUND FLOOR PLAN°

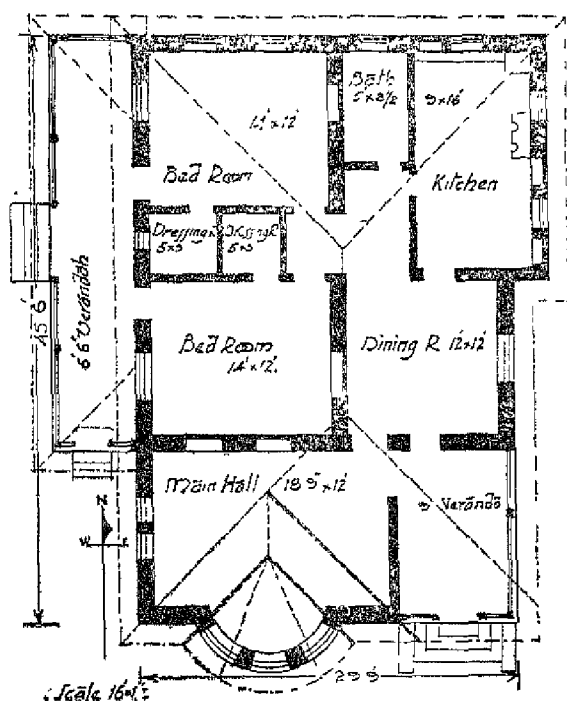
Scale 1/16" = 1'

FIG. 46

tion increased the width of the rooms by —A no small advantage in small cott roof is very simple and yet attractive. area is 1300 sq. ft. and the cost Rs. account of the central long and wide p plan has lost its economic advantage. living area is 800 sq. ft. and is only 61 Plinth area.

Plinth Area 1475] PLAN NO. 10 [Cost Rs. 6600

This is a typical plan of a cottage designed

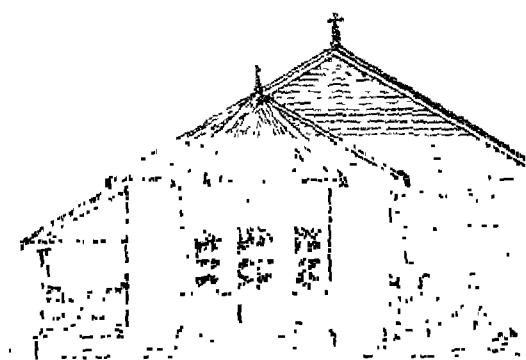


: GROUND FLOOR PLAN :

FIG. 47

especially to suit hot climate. It faces South, there is a verandah of 9 ft. width at the entrance which would serve as a waiting room. The kitchen and dining room being on the East would be flooded by the rays of the morning sun. The two bed rooms on the West side are further protected from the sun's heat by a verandah on that side. A special convenience of a small dressing room is made in each bed room. If bed rooms are separated by a partition wall they lose a certain amount of privacy as the partition wall is not sound proof. The device

adopted here viz, separating them by rooms guarantees that privacy. The kitchen is very good viz, $16' \times 9'$ and it is with a number of cupboards. The bath though only one in the whole house, is as a very convenient place. The door from hall to the dining room can, with advantage, be closed. The curved bay window in front



: FRONT ELEVATION

FIG. 48

drawing room lends a peculiar charm to the interior. The plinth area is 1475 sq. ft. and the floor area 1121 which bears a proportion of 70 to the former. The roof as shown by the lines on the plan is very simple. The verandah on the West side is shown detached at ends just for the sake of appearance. The cost of the cottage is Rs. 6600.

P. A. 1450 Sq. ft.] PLAN No. 11 [C

This is another type of a small cottage built on the old system of houses in villages, with a central hall and closed verandahs on all

portion of the front verandah is a little so that it provides an excellent sitting . This is a great improvement. Thin

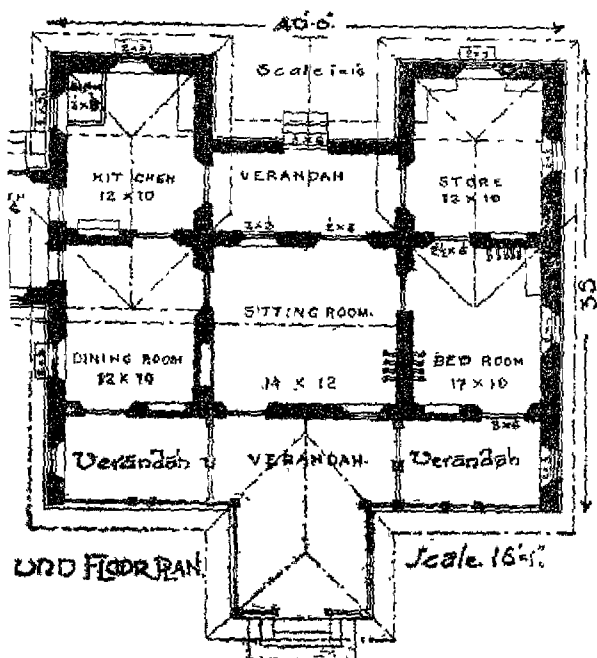
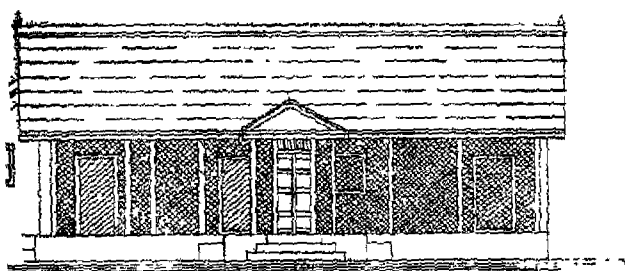


FIG. 49



FRONT ELEVATION
Scale 1/16"

FIG. 50

partitions across the verandah would make rooms for young boys and girls to study in. The bath room is built outside with

entrances from the kitchen, dining room and also from outside. The rear verandah can very well be used for dining, in that case the dining room proper, can be used as a bed room. The store room is rather big, but for a life in rural country a big room is required for that purpose for storing staple food grains etc. The plinth area is 1410 Sq. ft. and the cost of the building which is actually built, is Rs. 5100. The living area is 1045 Sq. ft. and is 72 p. c. of the P. A.

Plinth Area 1520 Sq.ft.] PLAN No. 12 [Cost Rs.6800

This is a plan designed on the same lines as plan No. 8, page 124 but with slight improvements.



FRONT ELEVATION.

Scale 16'-1"

FIG. 51

In fact both these plans are built side by side in the Sarsawat Brahmin Colony, Poona. Note the semi-circular surface on the inside of the octagonal bay portion which is very good from a sanitary point of view. Angles present a lodging place to nests of vermin on which also dust deposits. A provision of a small store room has been made near the kitchen. The small back yard is paved with Shahabad slabs and in the centre is installed a

plant so sacred to the Hindus. A bath, w. c. washing place are in a separate block detached from the kitchen by a blind wall and a 3 ft. beyond. The verandah behind the main

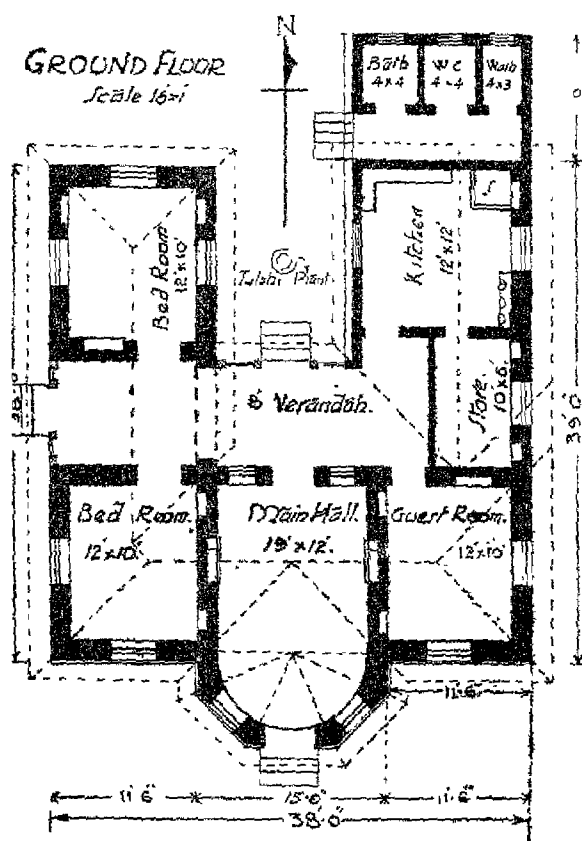


FIG. 52

ould be useful as a place for dining. The ng wanting is the omission of provision of lah either on the West or South side. The has two facings one on the south and the the west side. The area of the main block and that of the services 140 Sq. ft. and the ts. 6800.

Plinth Area 2139 Sq.ft.] PLAN No. 13 [Cost Rs

This plan illustrates the type of cottage on the system of purely Hindu Architecture. buildings are met with even now in villag

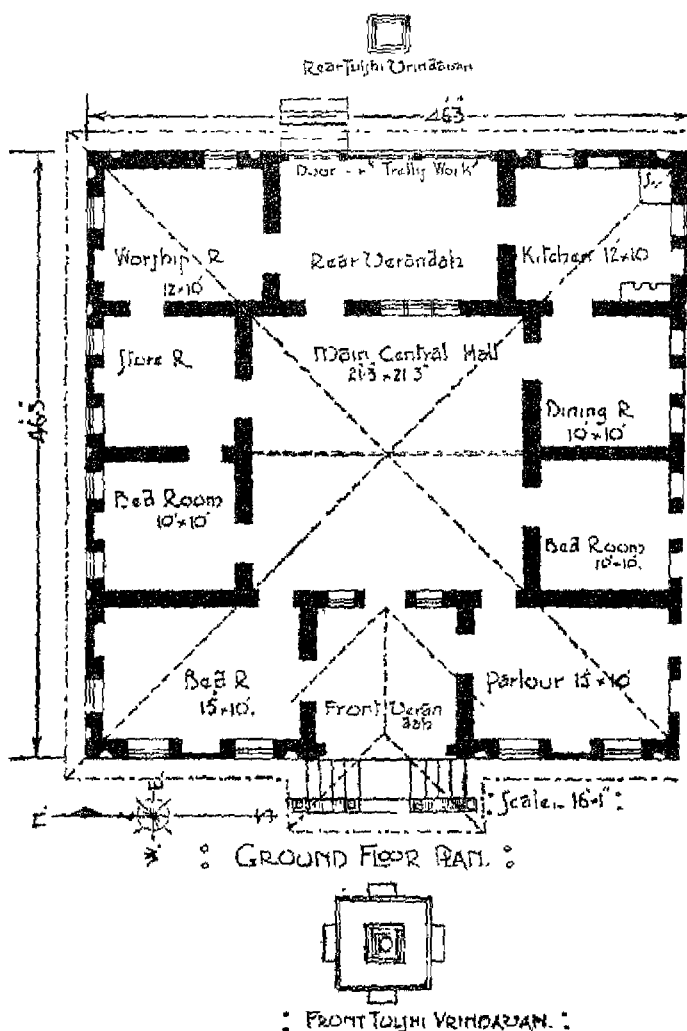


FIG. 54

the Konkan built by well-to-do people. The room is comparatively a very big one. It all its light and ventilation through the door

ows in the front and rear verandahs and is fore generally dark. In the houses of the r people an open chowk (lounge) is kept in entre of this room which sufficiently lights and late this part. One of the rooms near the store ing rooms is reserved as a sick room or a room dies in confinement. The approach steps to ain entrance are on both sides instead of in

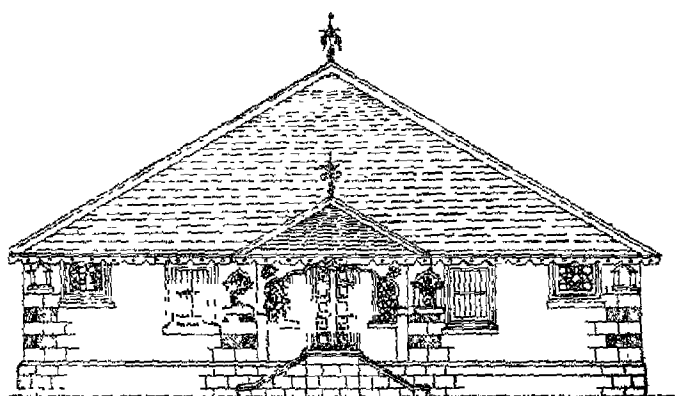


FIG. 55

: FRONT ELEVATION :



: ELEVATION OF TULSHI VṠ :

FIG. 56

front. There is a Tulshi *Vrindavan* both in front and the rear. The one on the front is shown in plan and elevation in figs. 55 and 56. 54 shows the elevation of the building. The door is a massive one mostly of *Umbar* tree h is very tough and offers the greatest resistance for an attempt to split it asunder with an

Ornamental thick brass washers are nailed on horizontal and vertical rails of the panels and to once the decorative effect an arch is construct-

ed over it. On either side of the doors there are latticed windows, the fret work of which, allows but a dim light inside. Beyond these windows on the front side there are two images standing erect on either side indicative of *Dwar-pals* or Guardian Angels. The iron barred windows beyond these are the appendages of the present day which produce a jarring effect on the eye as they do not harmonise with the old architecture. Further towards the ends there are again old pattern carved windows and in the corner there are two niches in which on certain days of the month two lamps fed with sesamum or other oil are kept burning in the evening time.

Plinth Area 1550 Sq.ft.] PLAN No. 14 [Cost Rs.7000

This bungalow is actually built at Khar, a suburb of Bombay. It is a very economic and

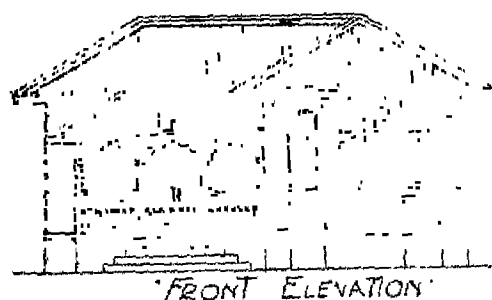


FIG. 57

convenient design. The sizes of all the rooms are very good. The drawing room in the front could be better used as a bed room. If it is intended at some future date to raise another floor a stair case can be best placed in the store room. If the room on the right hand of the rear side called bath room in the plan is used as a kitchen and the small

room 6' and $4\frac{1}{2}'$ adjoining it is made a bath room the present kitchen could be very well used as a bed room. The w. c. arrangement is proposed to be made outside the main building in a detached block. Fig 57 shows an elevation which is simple and yet

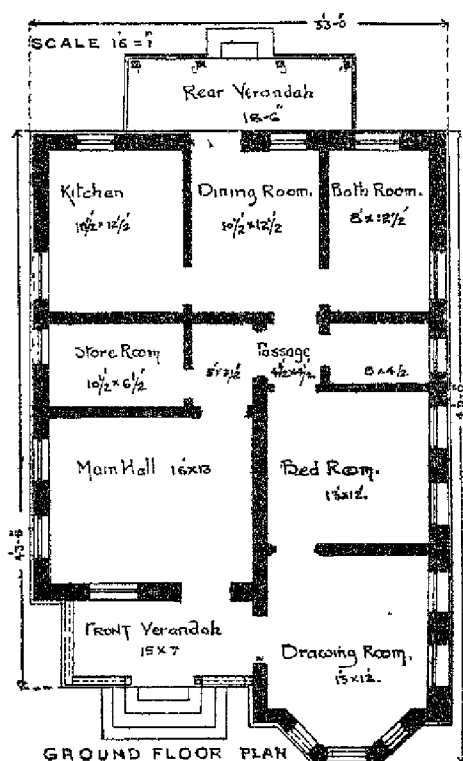


FIG. 58

artistic in appearance. Note that the front verandah is made about $2\frac{1}{2}'$ ft. shorter in length and a hipped roof constructed on that side which makes the roof look elegant. The plinth area of the main building is 1450 Sq. ft. and that of the rear verandah 100 Sq. ft. and the cost is Rs. 7000. The living area is 1185 Sq. ft. which bears a proportion so high as 76 p. c. to the P. A.

Plinth Area 1625] PLAN No. 15 [Cost

This small bungalow with an artistic

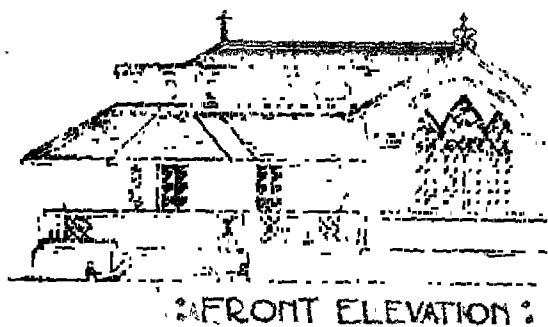
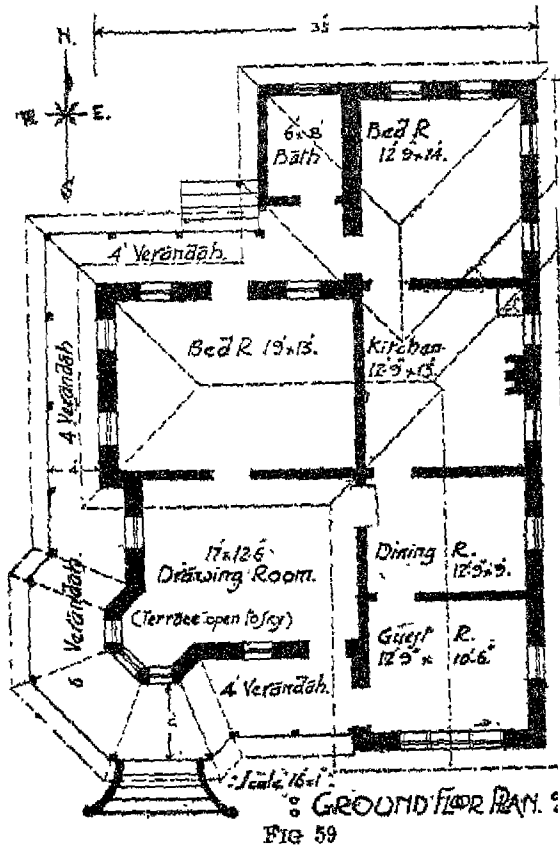


FIG 60

was specially designed for a well-to-do

as his country residence in summer on a hill side. Verandahs on three sides are specially provided. The sizes of all the rooms are good. The building is facing the South. The bath room which is meant to be commonly used, is on the rear side having an independent entrance to it. The octagonal bay window in the front corner of the drawing room surrounded on the outside by a similarly shaped verandah is a special feature. The kitchen is on such a side as to cause the least nuisance of smoke and strong smells. The arrangement first suggested was to make the rear bed room a kitchen and the present kitchen was to serve as a dining room ; but subsequently provision for a guest room was required to be made, for which the present modifications were carried out. Built essentially for comfort the bungalow is not an economic one; the living area is only 1160 Sq. ft. and is 63 per cent of the P. A.; the cost is Rs. 9400.

Plinth Area 2120] PLAN No. 16 [Cost Rs. 10500

This is a bungalow suitable for a Western or Southern facing. A 7 ft. deep verandah protects

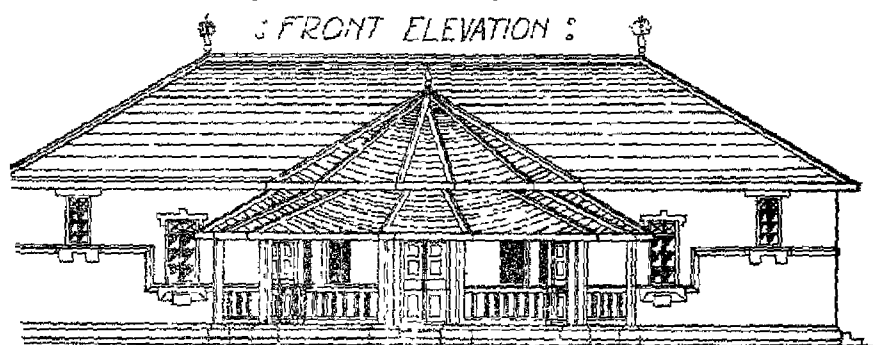


FIG 61

the central hall and two side rooms from the hot-

breeze. There are three decent sized bed each provided with a separate bath room. The room on the front can also be used as a bed in that event the small store room in front serve as its bath room. The kitchen which long and 8 ft. wide is a commodious one a wooden partition is erected at the place

∴ GROUND FLOOR PLAN ∴

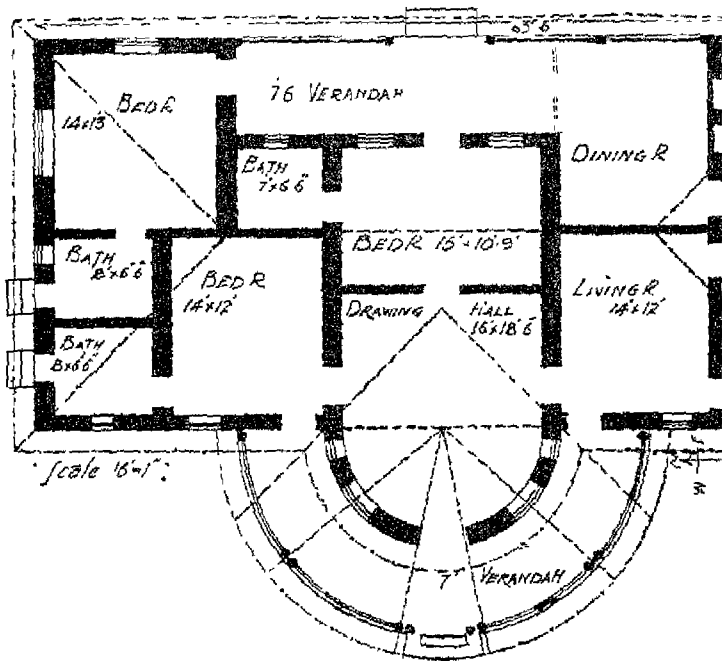


FIG. 62

dotted in the rear verandah, a spacious din of 16 ft x 12 ft is formed. The drawing 18' 6" x 16' would be a luxury. The design is suited to families who have adopted the modern manner of living. It contains all the features of an Indian house and still it provides the conveniences required for European style

[1940] PLAN No. 17 [Cost Rs. 8000]

is a common design much in favour of people particularly of the orthodox type who

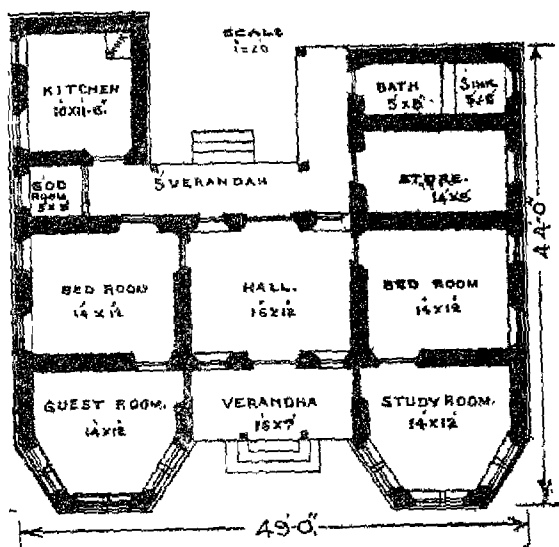


FIG. 63



— FRONT ELEVATION —
— scale — 16' — 1"

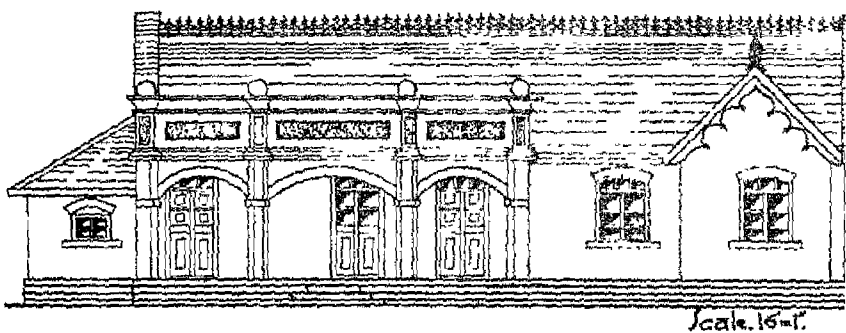
FIG. 64

it principles of old Hindu Architecture
d in a sweet mixture with the latest ideas
ight and ventilation. The building is
ical on the front side. The sizes of all the
cept perhaps that of the kitchen are very
he rear verandah if closed with a trellis

would be useful as dining place. A small God r in a secluded corner is a special feature. If a is constructed on the top of the bath room separate store room can be dispensed with the room occupied as an additional bed room. central hall would be a cool place to sit prote by verandahs on both sides. Though all the veniences are sought for, the grouping of room not made with particular attention to the direc of wind. Hence the design though much liked people has not got a sterling value. The ph area is about 1940 Sq. ft., the carpet area per cent of that, and the cost Rs. 8000.

Plinth Area 2184] PLAN No. 18 [Cost Rs. 10
Out-building 295] [Cost Rs. 79

This plan correctly represents a building actu built, the actual elevation, however, is by no me impressive hence it is considerably modified without altering the plan to the slightest ext The kitchen block is cut off from the main build



FRONT ELEVATION.

FIG. 65

and joined to it by means of a covered pass There is a nine ft. verandah in the front wh

s as a very good sitting out place. There are
 ed rooms of a decent size, one of them is very
 odious viz. $25' \times 12' 6''$. Each bed room has a
 and dressing room and also a small verandah

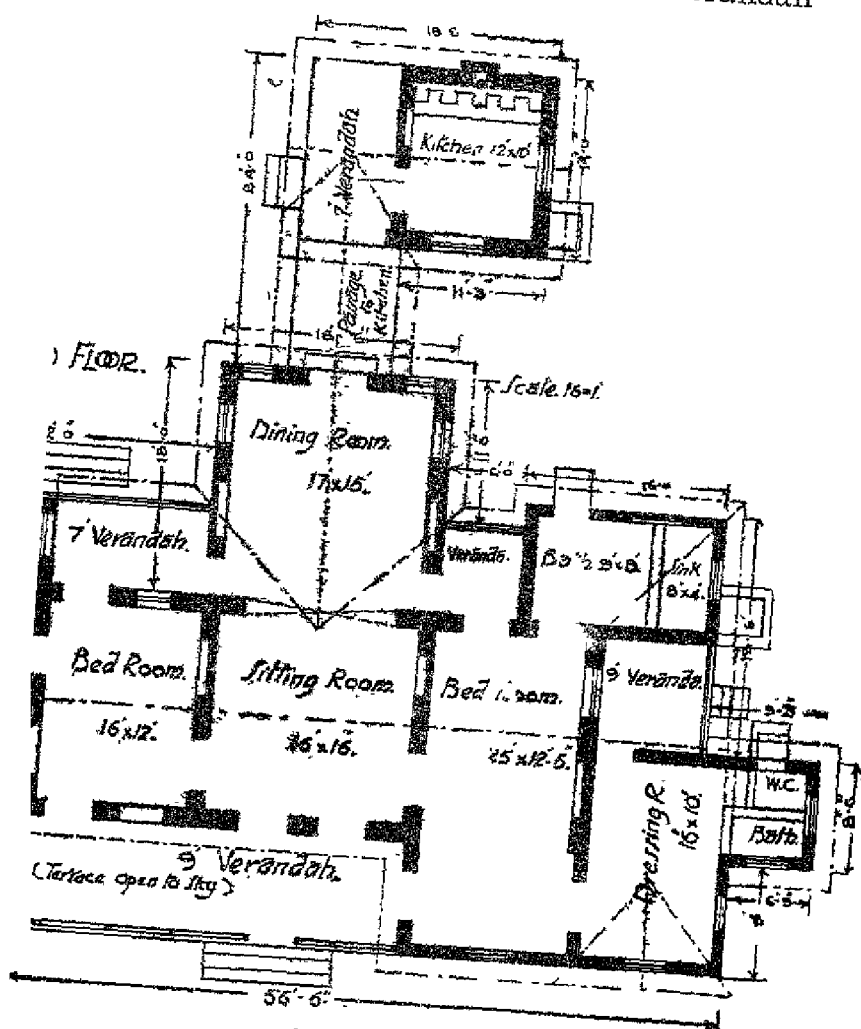


FIG. 66

hed to it. The dressing room in front to
 1 also a bath room is attached can be utilised
 ionally as an additional decent bed room. The

sitting and dining rooms in the centre are connected together by an arch, the arched opening being temporarily closed by a moveable screen. Thus these two rooms can be made into one spacious drawing hall on certain ceremonial occasions. By w. c. in each bath room is meant a commode arrangement. For this purpose each bath is accessible to sweepers from outside. The plinth area is 2480 Sq. ft. and the cost is Rs. 11000.

Plinth Area 2884] PLAN NO. 19 [Cost Rs. 13000

This plan is particularly suitable to the Indian manner of living. It is designed to face the west. There is a $6\frac{1}{2}'$ ft. verandah on three sides in the front. A commodious drawing room $22' \times 14'$ is

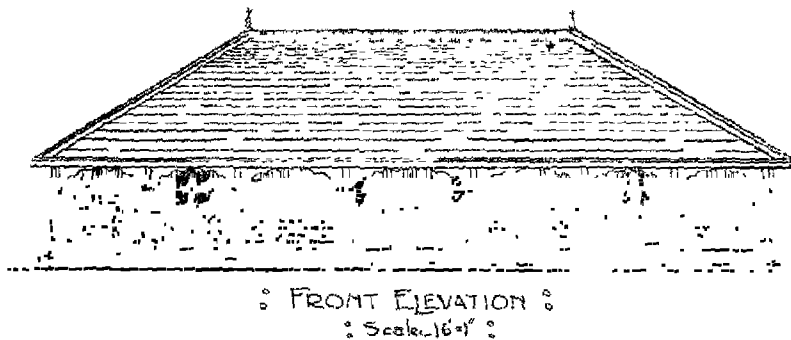


FIG. 67

placed in the centre with two bed rooms $12' \times 15'$ on either side. A toilet room is attached to every bed-room. An open chowk separates the main building from the out houses in which a spacious room $10' \times 19' 6''$ provides both for a kitchen and a dining room. There are two w. c.s, a bathroom, a store and a fuel room. A servant's room separated by a blind wall, with an entrance from the outside

a spacious garage make the cottage self-
 ained in every respect. The Plinth Area of
 main building is 1736 and that of the out build-
 1148 Sq. ft. The total cost is Rs. 13000. If

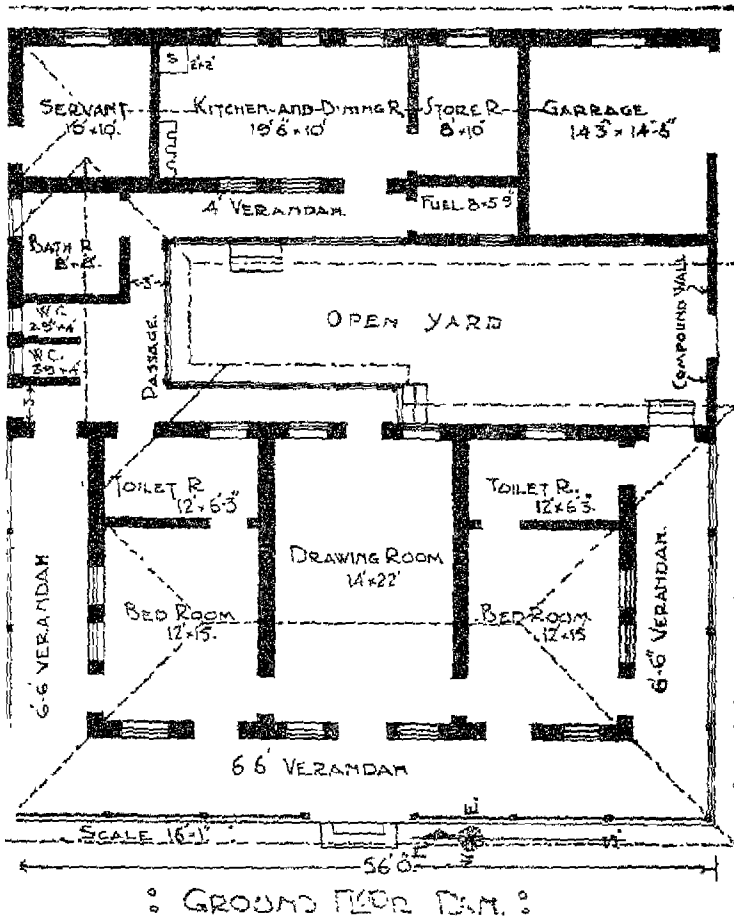


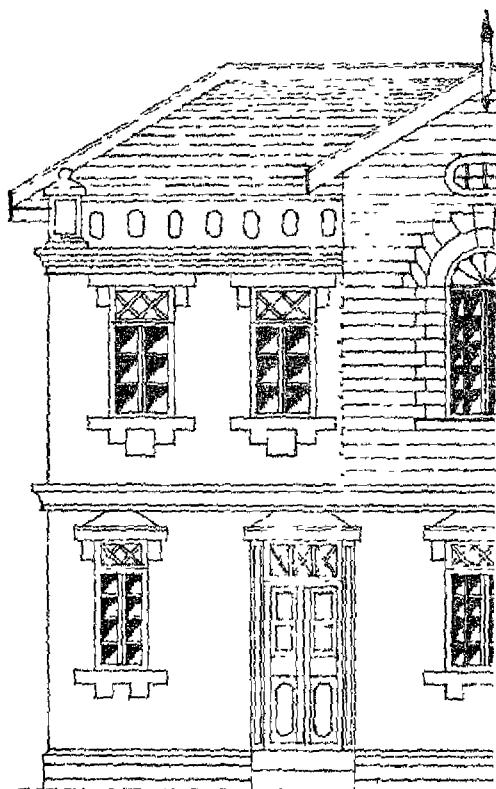
FIG. 68

permits it is desirable to remove the out-houses
 a little further so as to increase the width of the
 yard.

STORIED COTTAGE

Floor Area 1148] PLAN No. 20

This is a plan of a small cottage nearly square in shape. The front is a living room. The latter is a good such a small cottage. On the left hand entrance is placed a staircase. Be

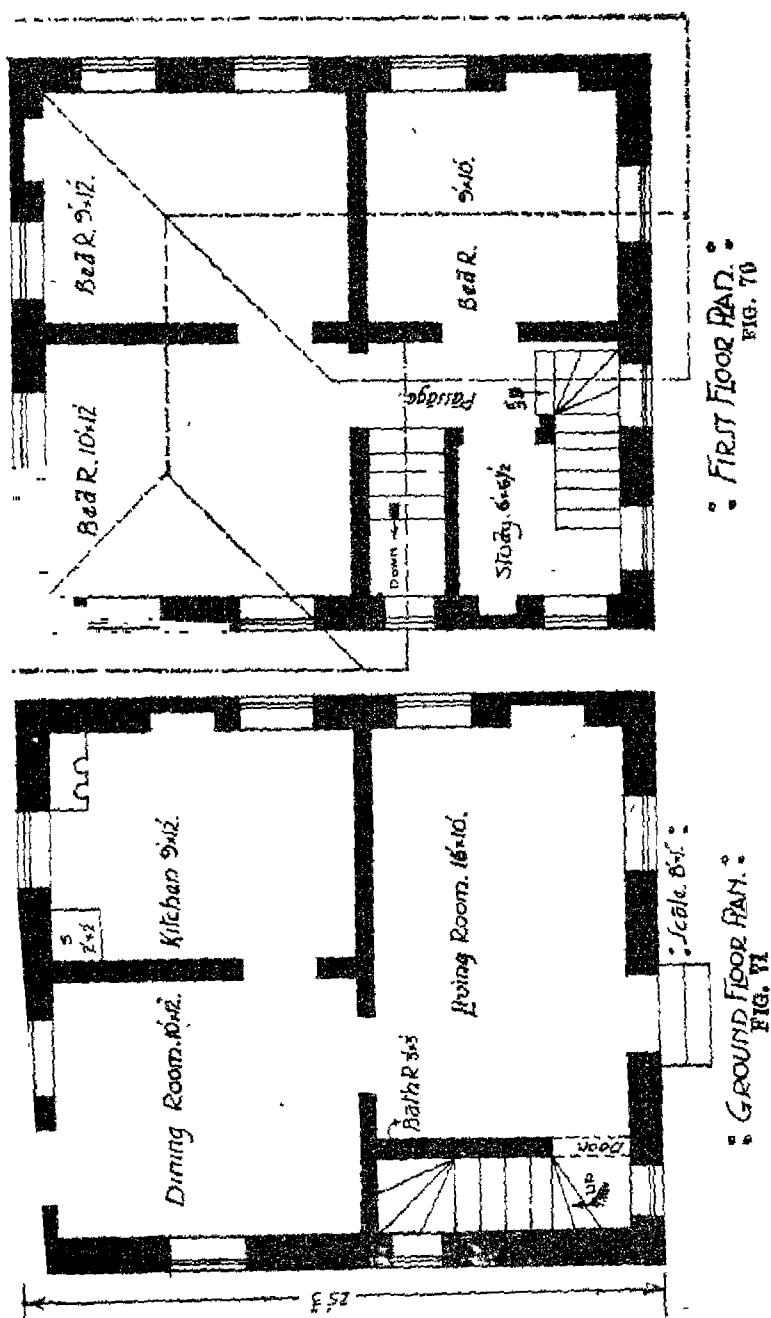


° FRONT ELEVATION. °

FIG. 69

room are situated the kitchen and dining room. Both of them are sufficiently big rooms.

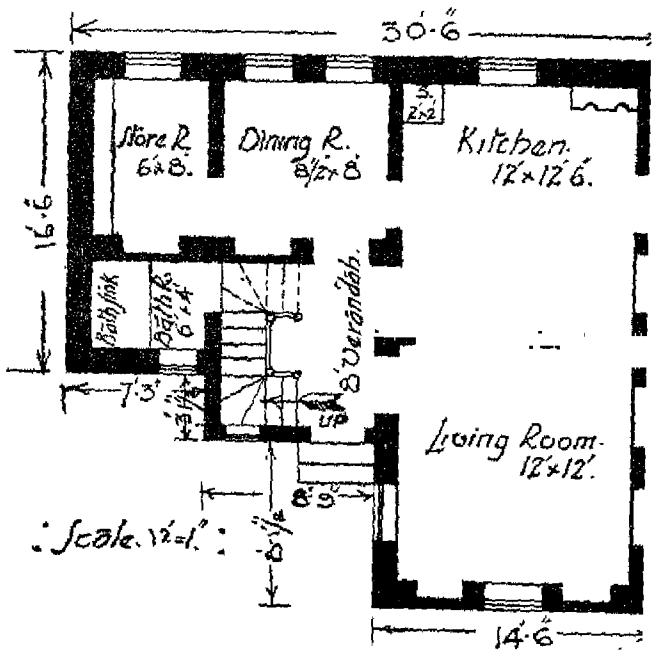
a door from the dining room towards a privy



which will be somewhere on the rear side. room has been provided underneath the stairs. On the first floor, there are three bedrooms and a small room for young boys for study staircase adjoining the two front windows. first floor is for going up to the terrace top of the study room. Behind the terrace a room has been provided, for which the wall has been raised to an extra height of 2ft. The area is 1148 and, the Living area 745 s. ft. v 65 p. c. of the former. If the area of the attic is taken into account the proportion would be much higher. The cost is 4530.

Floor Area 1190] PLAN NO. 21 [Cost

This is a plan of a small compact cottage



South-west. Upon entering through the front

meets with the living room on the right hand and on the left hand there is the entrance to the staircase. The kitchen which is a comparative-ly small room will partially compensate for the smallness of the dining room. A store room of $6' \times 8'$ is located near the dining room. The bath room is

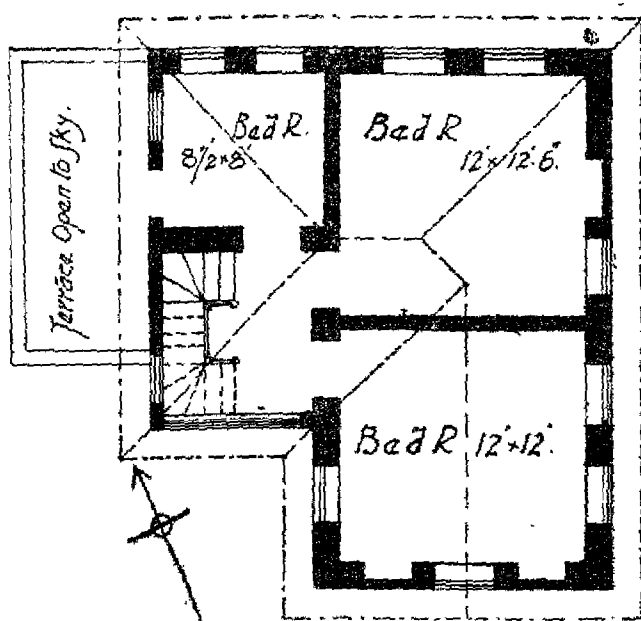
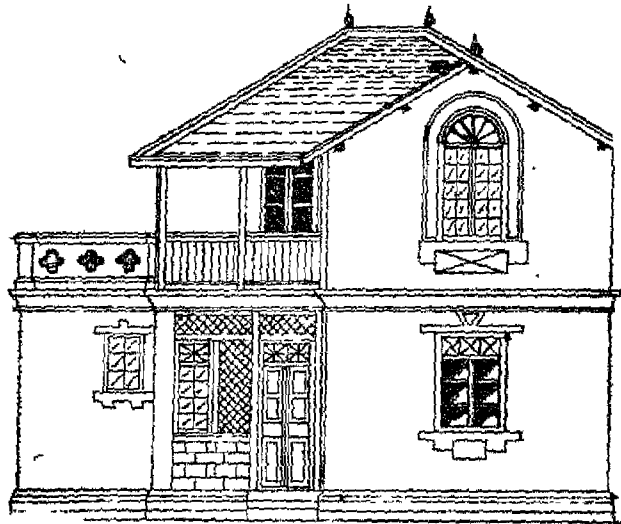


FIG. 73

and the staircase to which there is an entrance from its landing. There is no spare room either for the young or the aged or invalid on the ground floor. On the first floor three bed-rooms are conveniently arranged. The Plinth area of the ground floor is 1187 s. ft. and the total Floor area is 1187 s. ft.

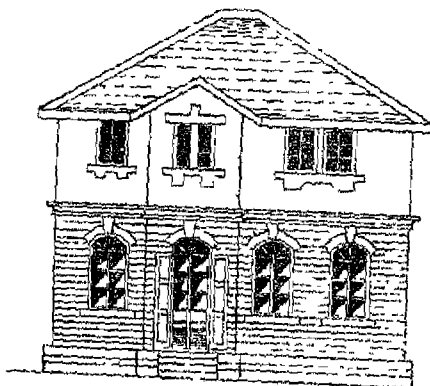
the cost should not exceed 5000 Rs. The



area is 820 s. ft. and bears a ratio of 70 % to F. A.

Floor Area 1420] PLAN No. 22 [Cost R

This is a plan of a small square cottage



FRONT ELEVATION.

Scale. 15=1'

FIG. 75

rooms are few in number but they are very good. On the ground floor there is a kitchen 8' x 13', a living room adjacent to it which could be used as a dining room. The space below the staircase could well serve as a room. On the

upper floor upon ascending the staircase all the bed rooms are immediately accessible. There is also a dressing room of 12' x 4' in a corner such

could be used by all in common. A successful attempt has been made in this design especially on the first floor to reduce to a minimum the space usually lost in lobbies. The outer walls are of stone in lime $1\frac{1}{2}$ ft. thick to afford protection from heat and give safety from thieves and all the internal ones are $\frac{1}{2}$ brick thick i. e. 6 inches including plaster on both sides with intermediate timber posts to support the superincumbent weight of floor. The cost of the cottage is Rs. 5540. The Carpet area is 984 s. ft. which is 69% of the Floor area.

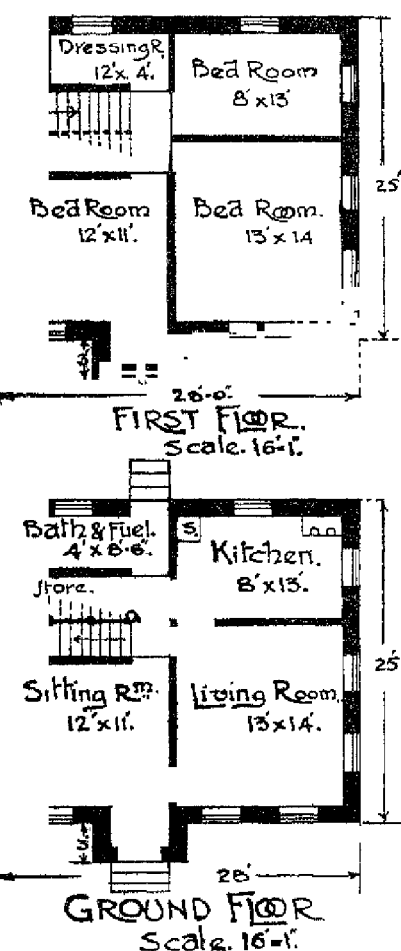
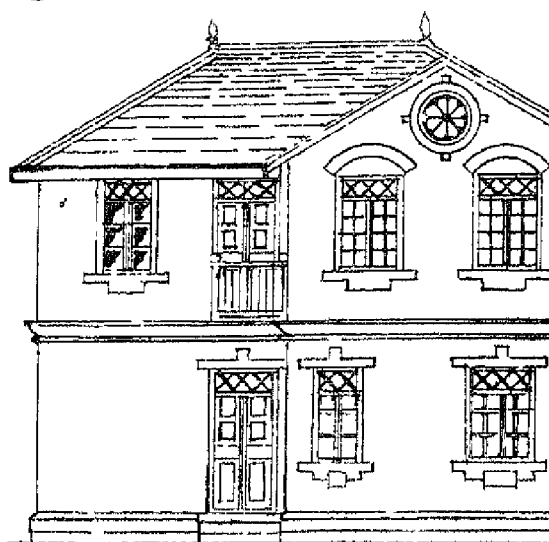


FIG. 76 & 77

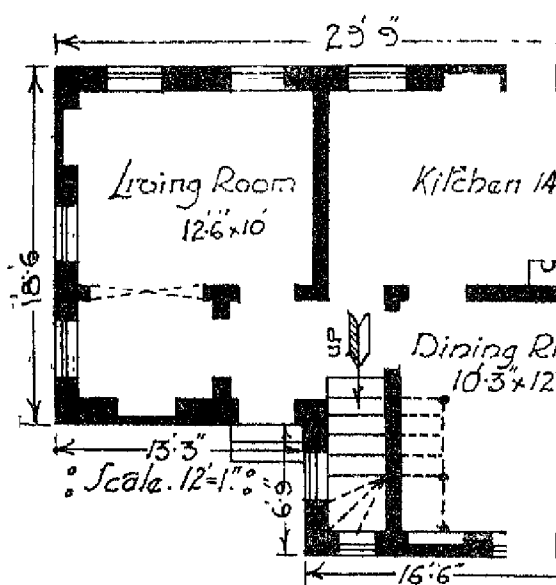
Floor Area 1324] PLAN No. 23 [Cost Rs. 5500

This is another very compact plan of a small building. There is a small lobby in front of the entrance which opens into a living room. A part of the living room can be turned into a small study room by putting a screen below the arched

opening. The size of the kitchen is good



◦ FRONT ELEVATION



◦ GROUND FLOOR PLAN

The dining room is commodious. The s

at a very convenient place. Upstairs there are three bed rooms and a toilet room. Two of the rooms are spacious enough. The elevation shown in fig. 78 is graceful. A number of wall

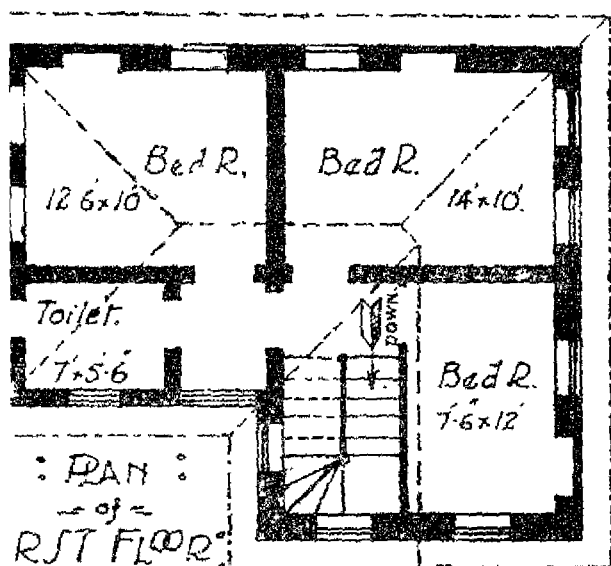


FIG. 80

has been provided. The living area is which bears a proportion of 65% to the area which is 1324 sq. ft.

1352] PLAN NO. 24 [Cost Rs. 5630

is one of very economic designs of a small cottage. All the outer walls are of stone in $\frac{1}{2}$ ft thick and the inner ones are made of gongg, that is, vertical posts at 5 to 6 ft. joined together by horizontal timbers, the plate space being filled with brick work in inches thick. On the ground floor there is a room in the front, and a kitchen and a room on the rear. A bath room attached on

the left hand side is accessible from the outside also. The staircase is an easy one with no winders.

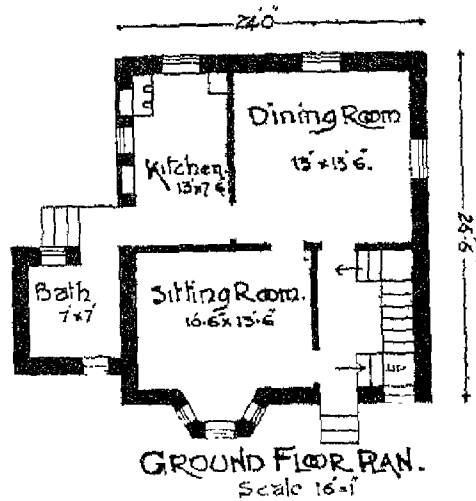


FIG. 81

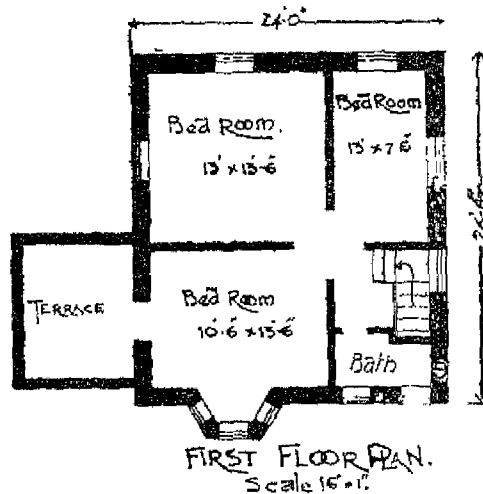
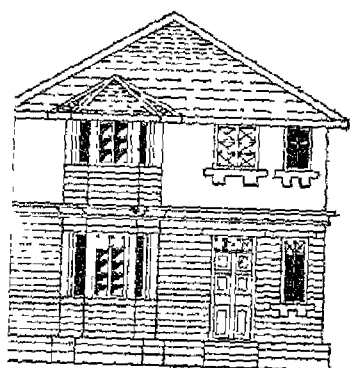


FIG. 82

An attempt has been made on the first floor to save space in lobbies by arranging all the doors at one place. But from the point of view of privacy it is not a desirable thing. Because if the doors happen

, one standing in the centre gets full view



FRONT ELEVATION:

Scale, 16'-1"

FIG. 83

of the inside. There is also a bath room on the first floor independently approachable from any bed room. The bay windows are just for lending an expression of beauty to the elevation.

The Floor area is 1352 sq. ft. and the Carpet area bearing a proportion of 67% to the former, is 5631 Rs. The abstract of cost is given

	Rs.
tion for foundations	11
concrete	175
y in founds	84
linth	148
tructure of outer walls	1355
artitions	390
	522
ws	566
ig	400
	275
	720
ing, white and colour-washing	520
ng on outside	115
se	150
ing—(Oiling wood-work, sink, shelves,	200
, left etc)	

5631

Floor Area 1489] PLAN NO. 25 [Cos

This smart little cottage is a conv

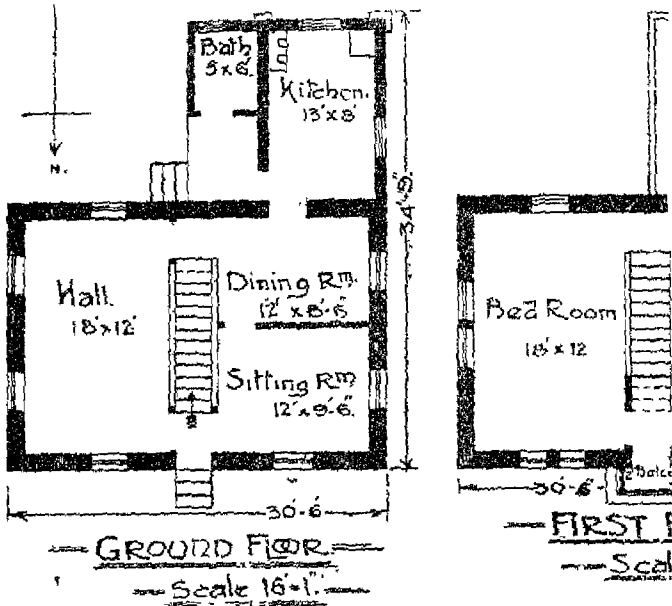
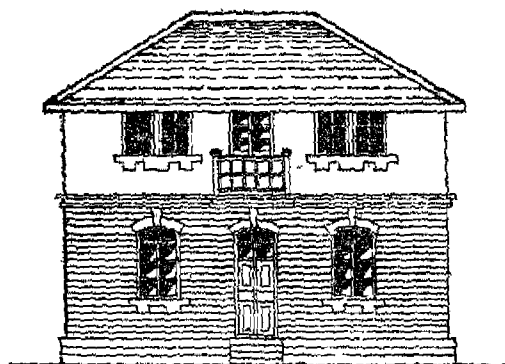


FIG. 84 and 85

On the ground floor, there is a spacious



FRONT ELEVATION.
Scale 1/8" = 1'

FIG. 86

which is attached a small bath-room

room
ing 18
on the
side
sitting
x 9' (1
which
room
the
The
placed
extens
rear

h. The space below the staircase can be a store. On the first floor there are three bedrooms and a terrace, the latter is accessible from any of the rooms. The plan is suitable for a North facing house.

The plinth area is 848 sq. ft. and the total area is 1489 sq. ft. The cost of the cottage is Rs. 6500. If half the terrace area is included in the plinth area the latter is 1030 sq. ft. and is 70 per cent of the F. A.

Area 1710] PLAN NO. 26 [Cost Rs. 6500

This is another very conveniently designed cottage suitable for a facing of North or West. It has a seven ft. verandah in the front which

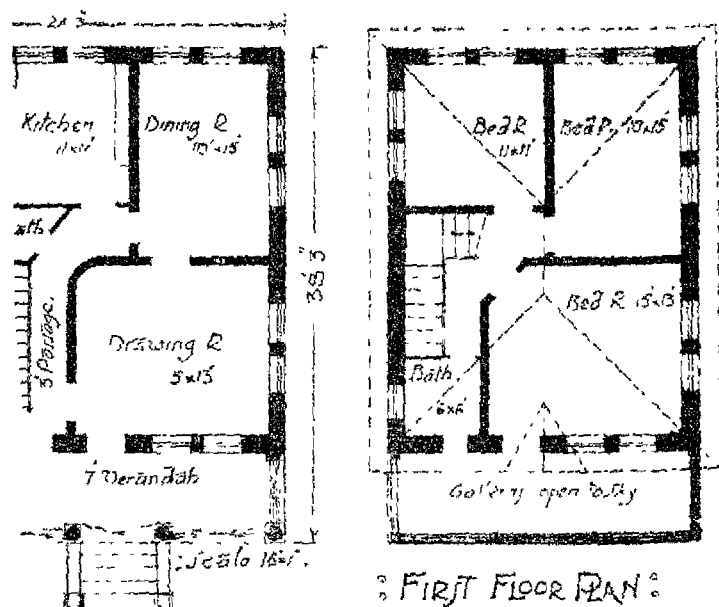
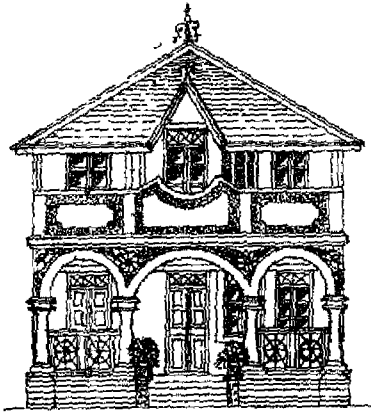


FIG. 87 and 88

leads into a drawing room 15 ft. by 13 ft. The staircase has an independent opening either from inside

or from the outer verandah. A small bath room is



; FRONT ELEVATION.:

FIG. 89

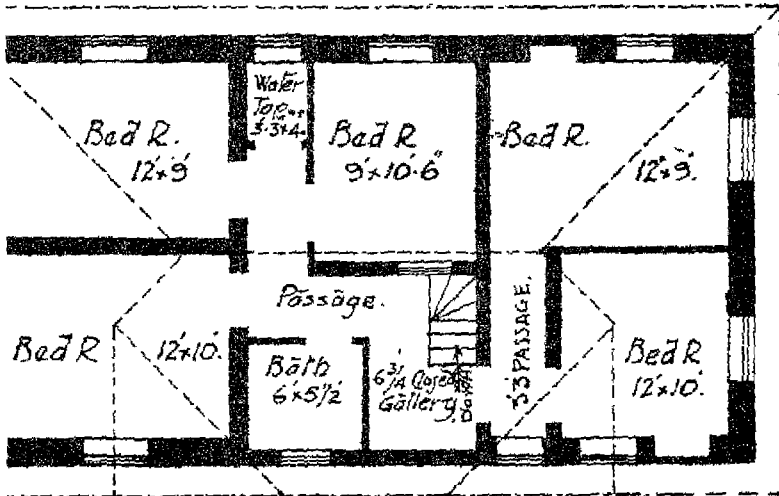
the three bed rooms are all of good sizes with separate entrance to each; there is in addition a bath 6' x 6' common to all and a 7 ft. gallery on the top of the front verandah independently accessible from all bed rooms. The roof is a very simple one. The building has got a smart and attractive elevation as shown in fig. 89. The Floor area of the cottage is 1710 sq. ft. and the cost is 6500 Rs. The Carpet area is 1130 and bears a ratio of 66 per cent to the F. A.

arranged below the landing of the staircase and is independently accessible from any room. The kitchen will be in the N.E. or S.E. corner according as the cottage faces the West or North respectively getting the benefit of the morning sun. The dining room has got a decent size viz. 10 ft. by 13 ft. On the first floor

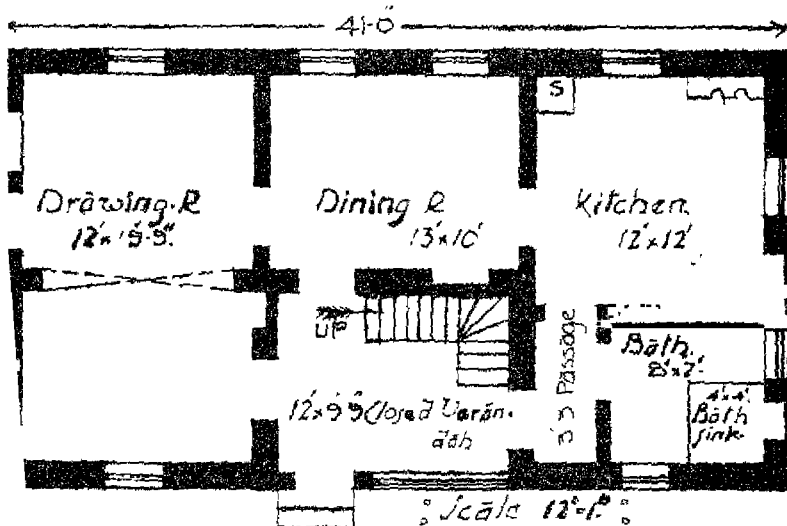
Floor Area 1824] PLAN No. 27 [Cost Rs. 7000

This is a plan suitable for an oblong plot of land with a wide front. The front entrance opens into a small verandah on the left hand side of which there is a commodious drawing room. A temporary partition placed across the latter below the arch would make two small rooms if necessary. The kitchen and dining room are both spacious and

bath which is a good sized room is further



° FIRST FLOOR PLAN °

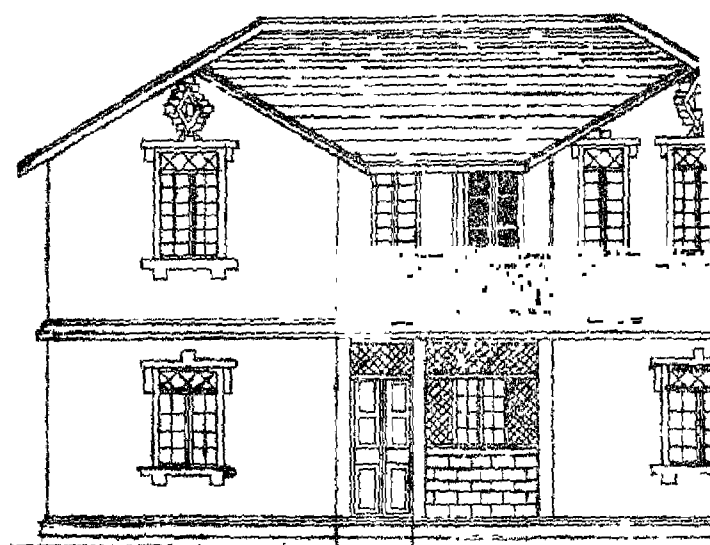


° GROUND FLOOR PLAN °

FIG. 90 and 91

ached by a lobby. The staircase is very conveniently placed. Upstairs are arranged, 5 decent rooms quite independent of each other. Thus

the plan provides for all that is desired in a cottage with the greatest economy of space. ever, a back exit from the dining room or a from the kitchen would further add to the



: FRONT ELEVATION. :

FIG. 92

nience. The elevation which is shown is equally attractive. The Floor area is 18 Living area 1256 bearing a proportion of 6 former and the cost is 7000/ Rs.

Floor Area 1920] PLAN No. 28 [Cost

This is a small cottage suitable for facing. The staircase is placed just in the entrance to the living room which screened from the people going up by a removable cloth curtain. On the floor there is a kitchen which is rather spacious dining room, and a decent sized b

would serve as a female apartment or a

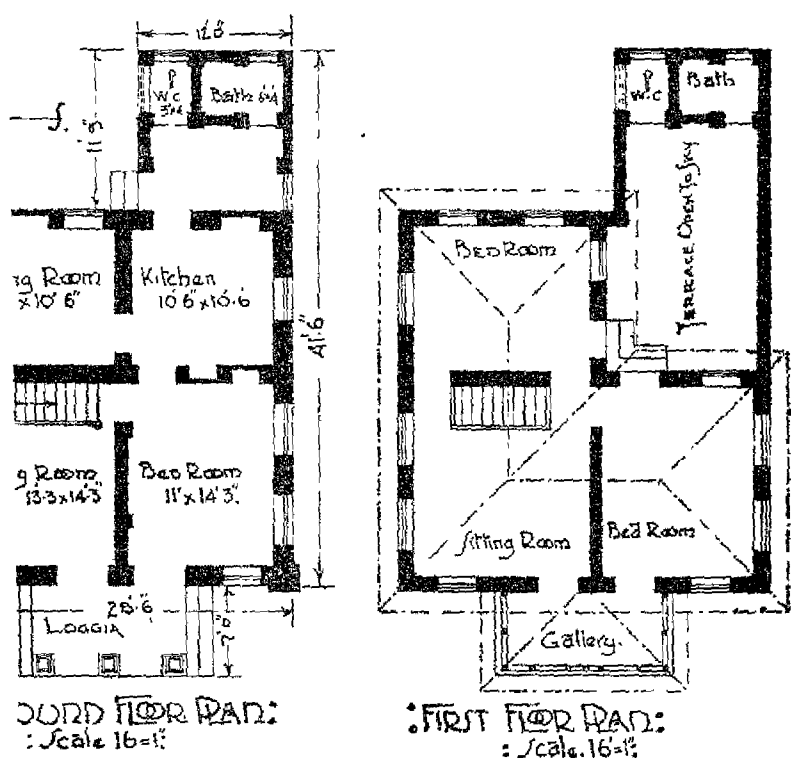


FIG. 93 and 94

: Room. The bath and w.c. block is separate from the main building by means of a 6 ft.

The entrance to the w. c. could, with glass, be screened from sight from the kitchen. A loggia (verandah) is provided on the ground floor which would make the living and bed rooms on the ground floor comfortable. On the first floor the arrangement is the same as below but a terrace is constructed on the top of the building and the lobby beyond. It is possible to provide commodious wardrobes on the upper floor in the space above the beginning of ascent of the stairway in both the bed rooms, with a common

back for both (wardrobe is not shown in the plan). A covered gallery is provided on the top floor verandah below on the west side. The total area of the cottage is 1920 sq. ft. the Cost is Rs. 7200.

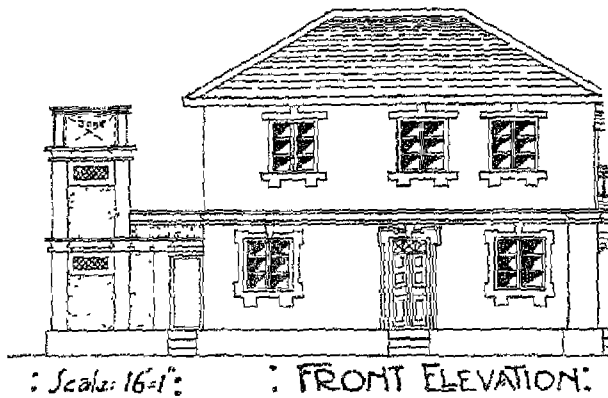


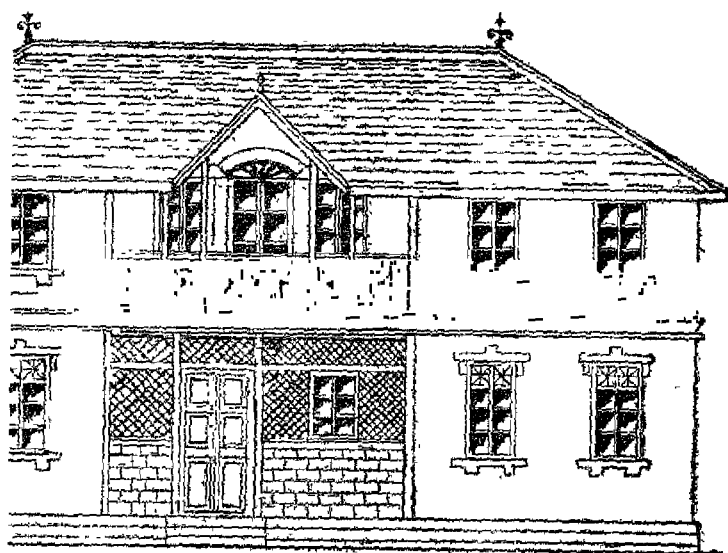
FIG 95

is 1348 sq. ft. including half the area of the verandah above. The proportion of Carpet area to Floor area is 70 per cent. The cost is Rs. 7200. Fig. 95 shows the North elevation.

Floor Area 1890] PLAN No. 29 [Cost Rs. 7200]

This plan of a cottage is suitable for a family of four which has a wide frontage but a small depth. At the front there is a closed verandah to serve as an entrance hall in which a staircase is arranged on one side which occupies a minimum space. The kitchen and dining room occupy the left half of the plan. There is an exit door in the kitchen on the right side. The drawing hall is comparatively a spacious room but is close to the kitchen. It is, therefore, advisable to devote the hall to use as a study or an apartment and the room on the right to use as a bedroom 12' x 18' ft. as a spacious drawing room.

has an entrance in the front verandah.



: FRONT ELEVATION. :

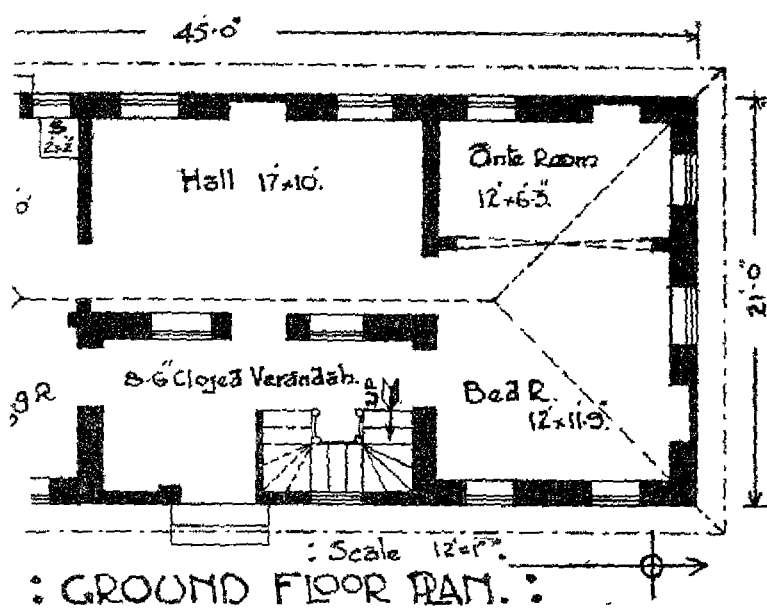


FIG. 96 and 97

one of the rooms upstairs could also be conveniently used as a drawing room. There is no bath provided inside the building on the ground floor. It must be built in a detached position somewhere outside. The total Floor area is 1890 s. ft. and the cost is Rs. 7300. The Living or Carpet area is 1420 sq. ft. which is 75 p. c. of the F. A.

Floor Area 1680] PLAN No. 30 [Cost Rs. 6900

This little cottage is an example of how a small building if designed well can accommodate

GROUND FLOOR.

Scale 12"=1'

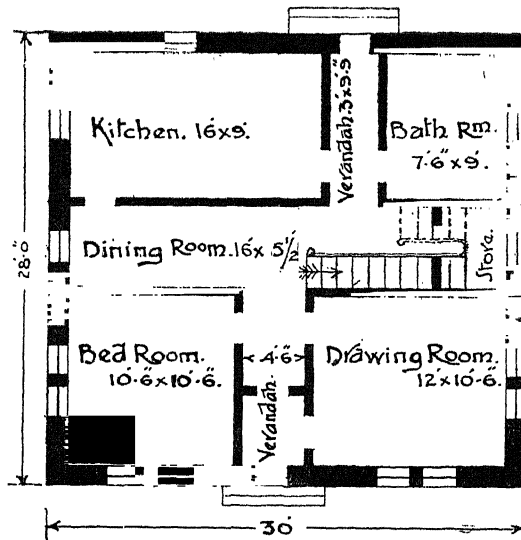


FIG. 98

very conveniently 10 or 12 members of a family. Even the narrowest space is well utilised therein. The entrance to drawing room is through the small